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A photogrammetric investigation of facial variation in Tanzanian and British populations

DAVID BLACKWELL

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ABSTRACT

The research topic involved an investigation of the facial characteristics of subjects from Great Britain and Tanzania. The meth-odology used was photogrammetry, which is indirect anthropometry using standardized photographs of the face. The material is presented in the following way.

In Chapter One there is a brief description of the development of this study and a statement of the aims and objectives. This is followed by brief histories of the development of photogrammetry and of the study of the face.

Chapter Two contains a description of the population samples from both Tanzania and Great Britain including their origins and numbers. The tribes of Tanzania are also described with their geographical loca-tions and relationships with one another.

This is followed in Chapter Three by a description of the methodology used in this investigation and a detailed account of the landmarks used and of the measurements taken.

Chapter Four contains an account of the various sources of error which may have occurred in this study, methods taken to reduce these and other methods which could have been used to minimize error.

In Chapter Five the various forms of statistical analysis is described. The indices computed, descriptive statistics, univariate and multivariate analyses are explained.

The results obtained are set out in Chapter Six and discussed with reference to the two populations studied and various sub-groups.

In Chapter Seven various theories of facial proportion and beauty are described. Some are selected for testing and the method used is explained. The sample of models and results obtained are described.

Chapter Eight contains the conclusions of the investigation with a comparison of other researchers work and suggestions for further study.

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D. Blackwell, B.A., M.Ed.

CONTENTS

CHAPTER ONE - INTRODUCTION

1.1 - Starting Points

This study stemmed from casual observations made by myself while teaching in schools in various parts of the North-East of England. It appeared to me that certain faces or particular facial characteristics were more common in one locality than in others. Furthermore, in particular towns or villages, certain pupils' faces looked very similar even though they assured me that there was no family relationship between them. I wondered if it would be possible to investigate whether or not certain facial characteristics were indeed more prevalent in one area than in another. The next problem was to determine how the differences in faces could be ascertained and recorded. Having had a scientific educational background I was interested in trying to express these differences quantitatively. This obviously involved measurement of the various parts of the face and recording the data obtained. I had, therefore, decided that I wished to carry out a quantitative study of the variation of facial characteristics in different populations. Two problems now became apparent; first which particular methodology should I use; and second from where should I draw my samples of the populations ?

Since I was to carry out the study in my spare time as a part-time student, my personal circumstances dictated the methodology to be employed. I required a method which would allow me to measure the faces when time was available to me, which was not always predictable in advance. Actual direct measurement of the faces of the subjects would have been too time consuming and inconvenient. I, therefore, decided that measuring from standardized photographs (photogrammetry) of the subjects' faces would be the ideal methodology for my requirements and circumstances.

The differences in facial characteristics which I had initially observed came from only one region. If population samples could be obtained from two areas which were widely separated geographically and environmentaly there would be a much greater chance of indicating any variation of facial characteristics.

With these ideas I, therefore, approached Professor Sunderland at Durham University who had access to a series of photographs taken of Tanzanian subjects' faces in standardized head positions which were available for me to use and had not previously been measured. Moreover, Dr. A. Redmayne, who had taken the photographs, was willing and able to increase the sample size by taking photographs on further trips to Tanzania and she would take them according to my specific requirements. Professor Sunderland also made available to me facilities for producing a British sample. I, therefore, decided on my two population samples; one from Tanzania and a second from Great Britain.

There was another area of interest concerning the face which I was eager to investigate. This was the concept of beauty and the idea of the ideal face. Was, I wondered, beauty truly in the eye of the individual beholder, or were there certain quantitative aspects of the face, that were generally held, which differentiated people with 'beautiful' faces from the rest ? I decided as a second part of my study to investigate some of the classical and modern theories and rules of proportions and relationships of facial parts and determine whether a sample of models' faces came closer to these ideals than did the sample of faces from the rest of Great Britain.

With these ideas in mind, I formulated a list of aims and objectives for the investigation, which is shown below.

1.2 - Aims and Objectives

(i) To determine if the populations of Tanzania and Great Britain can be differentiated between using data obtained by measuring the facial characteristics of samples of each country by photogrammetry.

(ii) To determine whether the populations of five Tanzanian tribes can be differentiated between using data obtained by measuring their facial characteristics by photogrammetry.

(iii) To determine affinities and differences between the five Tanzanian tribes and relate these to the geographical situation of the tribes within Tanzania and the degree of intermixing of the tribes that occurs.

(iv) To determine whether the population of the North-East of Great Britain can be differentiated from the population of the rest of Great Britain using the data obtained from photogrammetry of the face.

(v) To determine whether there are differences and similarities between male and female, and adult and juvenile members ofthe various populations and to identify them. To discover whether or not these differences and similarities are common to all of the populations.

(vi) To determine which variables, or set of variables, best differentiates between one population and another in the cases described above.

(vii) To determine whether the populations of Great Britain and a group of magazine models can be differentiated between using classical and modern rules of beauty and proportions needed for the production of the ideal face.

(viii) To determine which variables, or set of variables, best discriminates between the populations of Great Britain and the magazine models.

1.3 - A Brief History of the Development of Photogrammetry within the Framework of Physical Anthropology.

The origins of physical anthropology as a recording and comparative science may be traced to the voyages of the great travellers and explorers. The first account of interest to anthropologists was that written by Hanno, a Carthaginian navigator, describing a voyage he made about the year 1000 B.C. to the Atlantic Coast of Africa. Herodotus (484 - 425 B.C.) presented data concerning the inhabitants of Libya, Egypt, Greece, Asia Minor and Ethiopia. Scylax made several expeditions to the Mediterranean. In 450 B.C. he described the Iberians, Ligurians etc., and characterized them as distinct groups. Ctesias (404 - 358 B.C.), a Persian, left reports containing much information concerning the inhabitants of India.

Between the twelth and eighteenth century there were many great expeditions and voyages made which were chronicled, all contained first hand accounts of the new lands encountered and details of the inhabitants found. Some of these travellers are; Marco Polo (1254 - 1323) with his descriptions of the inhabitants of central Asia from Persia to China; Vasco da Gama (1469 - 1524) and other Portugese who explored the Azores (1432), Senegal (1445), Sierra Leone (1457) and the Cape of Good Hope (1486); Christopher Columbus in the Antilles (1492); Fernando Magellan in South America (1519); Pizarro in Peru (1524 - 1541); Abel Tasman (1642 - 1644); Francis Drake (1577 - 1580); Captain James Cook (1769 - 1779); James Bruce in Abyssinia (1768 - 1772); Peter Pallas in Siberia (1768 - 1774); Karsten Nieburgh in Arabia (1770); Mungo Park in Timbuktu (1795 - 1797); Peter Kolbe and

François Levaillant on the Cape (1779 and 1790) etc. It was during this period that the most divergent and primitive human races became known and the task of studying and systemizing the great mass of data obtained was begun.

Linné (1707 - 1778), Buffon (1707 - 1788) and White (1728 - 1813) inaugurated the science that was later to be called Comparative Racial Anthropometry, in showing that there were differences in the bodily proportions of the various human races.

Blumenbach (1752 - 1840) reported for the first time the complete anthropometric data available in his treatise, "On the Natural Differences in Mankind". The statistician Quetelet (1796 - 1874) is credited with founding the science and divising the term "Anthropometry" (from the Greek, anthropos, "human" and metron, "measure"). Anthropometry is thus defined as the biological science of the measurement of size, weight and proportions of the human body. Quetelet also is attributed with having conducted the first large-scale somatometric survey.

During the sixteenth century Vesalius started the science of anthropological craniology. He compared the cranial forms of Genoese, Turks, Greeks and Germanic people. Bernard de Palissy (1510 -1590) first suggested the use of precision instruments to measure the skull. Adriaan van den Spieghel (1578 - 1625) later made the first practical experiment based on the idea suggested by Palissy. The first serious application of craniometry is found in the work of Louis J. Daubenton (1716 - 1800) who was a collaborator of Buffon. Peter Camper (1722 - 1789) was another of the pioneers in craniometry especially in what may be called the projection method as applied to the skull and to the living. Camper utilized the plane of reference the 'norma lateralis'; Blumenbach conceived the 'norma verticalis' or 'superior'; Prichard initiated the use of the 'norma frontalis' proposing a classification using it. Later Richard Owen suggested a fourth plane, the 'norma inferior', while Laurillard (1837) used the 'norma posterior' or 'occipitalis'. All of these norms continue in use today.

Jan van der Hoeven (1801 - 1868) established a method for studying the human cranium based on eleven measurements . The Swedish anthropologist Anders Retzius (1796 - 1860) was the first to establish the relationship between cranial width and length in order to obtain a relative value which was called the length - breadth cranial index. Karl E. Von Baer, applying the same technique as Retzius, calculated the relationship between cranial length and height (length-height cranial index). Craniometric studies multiplied rapidly during the second half of the nineteenth century.

Humphrey in 1858 made careful measurement of bones (humerus, radius, femur and tibia) in 25 skeletons of caucasians and negro men. He too calculated indices. The next advance was the realization that many of the bone lengths could be measured on the living subject by obtaining their termini by palpation. Other landmarks on the skin surface (nipples, umbilicus etc.) were also found to be of value in studying proportions. Broca (1824 - 1888), founder of the Ecole d' Anthropologie in Paris influenced the upsurge of anthropology significantly through his theoretical research as well as by devising many measurement techniques and devices. His techniques became almost universally applied throughout Europe until 1870.

In 1914 R. Martin published the first edition of his famous 'Lehrbuch der Anthropologie' which remained the standard textbook for several decades.

The late nineteenth century and early twentieth century saw the development of a widespread interest in the detailed study of the living human and of the skeletal remains of early man in which physical anthropometry played an important part. Recruitment statistics provided military surgeons with data for research and notable studies were carried out during the American Civil War and the World Wars (Gould, 1869; Baxter, 1875; Davenport and Love, 1921; Hooton et al., 1948).

Alphonse Bertillon in 1882 devised a system of eleven easily taken body measurements used for establishing the identity of criminals. This system became known as Bertillonage. It was applied by Cesare Lombroso (1836 -1909) who was Professor of Medicine and Psychiatry at Pavia University and studied criminals. In 1876 he published " L' Uomo Delinquente", in which he propounded the theory of the 'delinquente nato' (born delinquent). Lambert Quetelet (1796 - 1874) was warden of Louvain prison in Belgium and he used anthro--pometry to measure criminals using the Bertillonage eleven measurements.

By the beginning of the twentieth century anthropometry had become an important branch of anthropology, expressed in an extensive and rapidly increasing literature. Individual investigations, however, used different methods and measurements. As a result, comparisons between results were difficult. Standardization of skull measurements was first attempted as a result of the International Congress of Anthropologists held in Monaco during April, 1906. The 38 skull dimensions and 19 living head and face measurements selected by the Congress have become the standards followed by anthropologists every--where. A second standardization of measurements for the rest of the body resulted from the International Congress of 1912 in Geneva. Martin's 'Lehrbuch' of 1914 in effect unified the measuring techniques to a large degree.

Anthropologists carried out anthropometric surveys in many countries. One of the largest of these was carried out by Hertzberg, Churchill, Dupertuis, White and Damon (1963)on Turkey, Greece and

Italy. Other surveys were carried out in Japan, Hawaii, Australia, Scotland, Wales, North America, South America etc. In East Africa two anthropometric surveys of note and relevance to this study were carried out by the German medical surgeon Friedrich Fülleborn on the peoples of Tanzania where he lived and worked just after the turn of the century. He published his data in 1902 and 1906 and included photographs taken in the standard Frankfort planes but did not use these for measurement but for identification and illustrative purposes only. The second study was by the Austrian anthropologist Oschinsky in 1954. His survey was just as detailed as Fülleborn's and contains masses of data.

The anthropometric technique used rulers, calipers and tapes (see Weiner and Lourie, 1981; Hrdlicka, 1920 and was applied by many anthropologists to the study of facial growth (Hellman, 1929; Davenport, 1940; Smyth and Young, 1932). The technique was time consuming and awkward and subject fatique introduced errors of movement. Although photographic techniques had long been used in anthropology to record characteristics qualitatively (e.g. Hrdlicka, 1925). The method of anthroscopy (from the Greek 'Skopien' - examine) means judging the body build by inspection (see Weiner and Lourie, 1981; Comas, 1960). These qualitative characteristics cannot be expressed numerically. It was not until 1940 when Sheldon, Stevens and Baker published their work on somatotyping that the camera began to be used for measuring purposes in the assessment of body physique. Two views were used for each subject and so was a special pose. Quantitative measurements were taken from the negatives. Tanner and Weiner (1949) used the photographic method to determine photogrammetric dimensions of the head and face. They modified and standardized the techniques to such an extent that they claimed the measurements obtained from their method of photogrammetry were equally as accurate as those obtained by direct anthropometry. Dupertuis and Tanner (1950) emphasized the need for accurate posing for photogrammetry. They used the photogrammetric technique to obtain data for the somatotyping of body form. Tanner has now used the photogrammetric technique for many years to study body growth of children quantitatively (Tanner, 1950).

In 1952 Gavan, Washburn and Lewis carried out an evaluation of the photogrammetric technique. Ehrhardt in 1956 produced a detailed study on photographic distortion demonstrating clearly the great difficulties attendant in using data obtained by the photogrammetric technique. Brothwell and Harvey (1965) used the photogrammetric method to investigate facial variation in four selected human populations (African Negro, North European, Tristan da Cunha and Mongolian). Alexander and Laubach (1968) carried out a detailed photogrammetric investigation on the ears of United States of America Air Force personnel.

Photogrammetry of the face has been widely used in recent decades in medicine, particularly in the fields of Orthodontics and Plastic and Reconstructive Surgery. It has been used as a diagnostic tool, an aid to treatment and for post-operative assessment by Stoner (1955), Neger(1959), Peck and Peck (1970), D'Ottaviano and Baroudi (1974), Sushner (1977) and Pech et al. (1978) and many others. Fraser and Pashayan (1970) and more recently Farkas, Bryson and Klotz (1980) have compared measurements taken by photogrammetry with those obtained from the same subjects using direct anthropometry in an effort to ascertain the reliability of the photogrammetric technique. Chapple and Stephenson (1970) have studied photographic misrepresentation, while Morello, Converse and Allen (1977) and Dickason and Hanna (1976) have written detailed summaries of precautions to be taken in photo--grammetry to minimize error.

One of the main problems associated with photogrammetry is the two-dimensional nature of the print produced . Various techniques have been developed to produce three-dimensional images. Axelsson (Deschin 1950) used a narrow light beam camera rotating the subject on the head and face. Lippert (1949) used string shadows cast on the subject with the camera placed at 90 degrees to the projector and head. Gavan, Washburn and Lewis (1958) and Hunt and Giles (1956) used a photometric camera system to take composite photographs of the whole body standing using nine mirrors. Herron in 1961 used three cameras at 90 degrees to give three dimensional measurement of the whole body in space. All of these methods used normal single-lens reflex cameras.

Stereo-photogrammetric methods using special stereo-cameras have also been devised. Zeller (1939 and 1952) used stereo-cameras and plotters to obtain contour maps of human faces with 10 mm separation between lines. Thalman-Degan (1944) improved Zeller's technique to produce contour lines of 5 mm separation for orthodontic diagnoses. Lacmann (1950) and Björn, Lundquist and Hjelmström (1954) used the same set up of two stereo-cameras but combined them with an automatic planimeter attached for the purpose of measuring post-operative swellings on the faces of patients. Savara (1965) used a custom built stereo-camera to measure facial contours and produced plots with an accuracy of 0.2 mm. Burke and Beard (1967) developed a simplified method which was less expensive for 3-D examinations of facial morphology. Burke (1979) evaluated the accuracy of his and other methods. McGregor, Newton and Gilder (1971) applied the stereophotogrammetric methods to an investigation of facial change after loss of teeth.

In recent years new techniques of optical contouring using projected grids and the analysis of moiré-fringes and interference patterns have been developed mainly in Japan (Takasaki, 1970, 1973 and 1975; Asai, 1978; Hojo et al., 1982 and Ohta et al., 1982) but also in

Britain (Graham and Sampson 1973 and Grew and Harris 1979) and in the U.S.A. (Karlan and Madden 1979). Telecentric photography using projected grids (Cobb, 1971; Lovesey, 1973; Robertson and Volp, 1961) and other new combined approaches morphanalysis, palatoprint and physioprint (Sassouni,1970) have been developed. The new techniques have used the computer to analyse the data and newly developed image--processing technique and scanning densitometers for reading and analysing prints and the data obtained from them. More detailed information about techniques for three-dimensional photography is given in Chapter Four.

Photogrammetry and Stereophotogrammetry have,therefore, been used in anthropology, in medicine, in orthodontics and in forensic science (Sassouni,1970). Engineering Anthropometry has long used photogrammetry as an aid to designing all types of implements from respirators to chairs and all of the garments worn by humans. It has also been used in the design for areoplanes and space craft. (see Roebuck, Kroemer and Thomson, 1975; Chaffee, 1961; Liau et al. 1982; Churchill and Truett, 1957). Photogrammetry has also been used for the study of growth which is a most useful index of child health (Tanner, 1962; Ainsworth and Joseph, 1976).

1.4 - History of the Study of the Face.

Interest in the study of the head and face is said to have started with the Egyptians some 3000 years B.C. Following the Egyptians the Ancient Greeks studied the proportions of the face. Theories on facial proportion were described by the Pythagoreans in the fifth century B.C. and later by the geometrician Euclid. In the fourth century B.C. Aristotle reported older writings on the propor--tions of the human face. The person regarded as being the first to formulate concepts about human aesthetics and the proportions of the face was Polykleitos, a sculptor of Ancient Greece. Since his time various artists have explored the concepts first put forward by him and have produced their own versions. Notable among these artists who have carried out studies on facial proportion and the ratio of the various parts of the face to each other are Leonardo da Vinci (da Vinci, 1957; Rosci, 1978) and Albrecht Dürer (Dürer, 1591; Russell, 1967).

In Aristotle's time the science of physiognomics (the art of telling character from the face and its expressions) was first initiated. Theories of physiognomy have been put forward intermittently ever since. The most famous student of physiognomy was John Caspar Lavator, a quiet, scholarly, eighteenth-century Swiss, who delighted in reading people's characters as a party trick. In 1783 Lavater published an essay in German on his art of reading character. This essay included 100 physiognomical rules concerning the various ratios and proportions that the nose, eyes and cheeks hold to the mouth, forehead and chin. He argued that the forehead and eyebrows generally reflected the intellect; the nose and the cheeks, the moral and aesthetic life; the mouth and chin, the animal or passionate life. His book must have caught the mood of the times for it was a huge success, a best seller first in Germany and Switzerland, and then, in trans-lation, in Britain, France and Italy, going into cheaper and abridged versions for even wider distribution.

In Britain Francis Galton attempted to find the 'criminal' face which could be used to detect the criminal type. He also made composite photographs by superimposing the photographic images of different individuals. As a result of their superimposition the common features were reinforced, but because of the differences between the individual images, the 'average' photograph was not shaply defined. Galton took composite photographs of 17 officers and 41 privates who were members of the Royal Engineers. He attempted to show the difference between the 'officer's' face and that of the private. He also produced composite photographs of a family of sisters to illustrate similarities of facial characteristics. Galton compared these to composite photographs produced from 30 female and 45 male members of an institute in Norwich (Pearson, 1924; Sheldrake, 1981).

Alphonse Bertillon, in 1896, devised a system of identifi--cation of people which consisted of eleven measurements some of which were from the head and face. Paul Topinard (1885) formulated a scheme for classifying facial features (e.g. nasal bridge form, nostril shape, lip shape) which is still in use today. Topinard's scheme, however, was based on subjective anthroscopy and no quanti--tative measurements were taken.

In the late nineteenth and early twentieth centuries measuring the human form (anthropometry) became the vogue in anthropology. One part of this was the measurement of the head and face. Various methods were employed by different researchers making the comparison of results very difficult. After the International Congresses of 1906 and 1912 measurements and techniques became standardized to a much greater degree than previously had been the case. The interest in anthropometry died out, however, in later years due partly to the unfortunate use made of some of the statistics collected using it by certain racist movements. Some disciplines continued to use anthro--pometry e.g. engineering anthropometry, growth studies of children, medical anthropometry.

In the second half of the twentieth century new interest was aroused in the study of the face. In anthropology Brothwell and Harvey (1965) and Brothwell, Healy and Harvey (1972) carried out investigations into facial variation using photogrammetry and analysed their results using canonical analysis. In the fields of plastic and reconstructive surgery Gonzalez-Ulloa (1962) and Calagirone and

Kostecki (1955) re-examined the canons of facial proportion for the construction of the ideal face with the purpose of using their findings in plastic and reconstructive surgery.

Various schemes were formulated for the analysis of the face. Poch (1916) and Watanbe (1960) attempted to classify the face as a whole. McLearn, Morant and Pearson (1927) devised a complex system for classifying facial pattern which was, at the time, very laborious and time consuming. Nowadays, however, with the aid of computers, the analysis is much easier to carry out (see Barrett, Brown and McNulty, 1968). Various workers carried out analysis of the facial profile (Björk, 1947; Stoner, 1955; Bowker and Meredith, 1959). Facial pattern analysis schemes have been formulated by; Dawbarn and Joseph (1964), and Ainsworth, Hunt and Joseph (1974) for use in the evaluation of the faces of children; Hellman (1939), Downs (1948), Churchill and Truett (1957), Hautvast (1971), Patterson and Powell (1974), and Bernhard et al. (1980) for adults; using a variety of methods.

Hellman (1927), Goldstein (1936), Hands (1955) and McNulty (1968) studied changes in the face resulting from growth and develop--ment. Facial morphology was studied using stereophotogrammetric methods by Haga, Koshihira and Ota (1964), Burke and Beard (1967), and Berkowitz and Cuzzi (1977). Lovesey (1966 and 1973) used projected grids for facial contouring and Moiré photographic methods have been used for facial analysis by Karlan and Madden (1979), Karlan, Madden and Habal (1979), Hojo et al. (1982), and Ohta et al. (1982).

1.5 - Plan of Presentation of the Study

In Chapter Two the population samples are described, including a description of where the samples were drawn from, how many made up the various samples and the sub-groups created from these samples. This is followed in Chapter Three by a description of the methodology used in this investigation. Chapter Four contains an account of the various sources of error which may have occurred in the investigation, methods taken to reduce them and other methods which could be employed to minimize error. In Chapter Five the various forms of statistical analysis are described. These were to be performed on the data collected. The results obtained are set out and discussed in Chapter Six. In Chapter Seven the various theories of beauty are described and the methodology for testing them is set out. The results of this part of the investigation are contained in the final section of this chapter. The final chapter, Chapter Eight, contains the conclusions drawn from the investigation along with a discussion of other researchers' work and suggestions for further work possible from this investigation. A Bibliography of books consulted in this study is included and finally, Appendices containing tables of results, finishes off the thesis.

CHAPTER TWO - THE POPULATION SAMPLES

2.1 - Introduction

The two populations studied in this investigation are from two distinct and geographically widely separated regions. The population samples are drawn from the British Isles and from Tanzania (Fig. 2.1). Within each region the populations were subdivided according to sex and age-range. In Tanzania photographs of subjects belonging to five different tribes were obtained, whilst in Great Britain a sample of subjects from North-East England was to be compared with a sample of subjects from the rest of the British Isles. These various sub-divisions enabled intra- as well as inter-population differences and similarities to be compared.

2.2 - The Tanzanian Sample

Tanzania was chosen as one area from which a population sample was drawn in this investigation because of four main reasons. Firstly, a series of photographs of the faces of Tanzanian subjects taken by Dr. Alison Redmayne, using standard photogrammetric technique, was available. Secondly, Dr. Redmayne indicated that she was willing and able to extend the number of subjects in her original Tanzanian series according to my specific requirements. Thirdly, Tanzania formed an excellent contrast geographically, culturally, and on first impressions, in the form of the facial characteristics of the subjects, from my other population sample of Great Britain. Fourthly, to my knowledge no one had undertaken this type of study using these two populations.

The photographs were taken by Dr. Redmayne in various parts of Tanzania. Some locations were in the North of the country around the Southern shores of Lake Victoria and others were in the Southern Highlands around Iringa and the Northern shores of Lake Nyasa. The

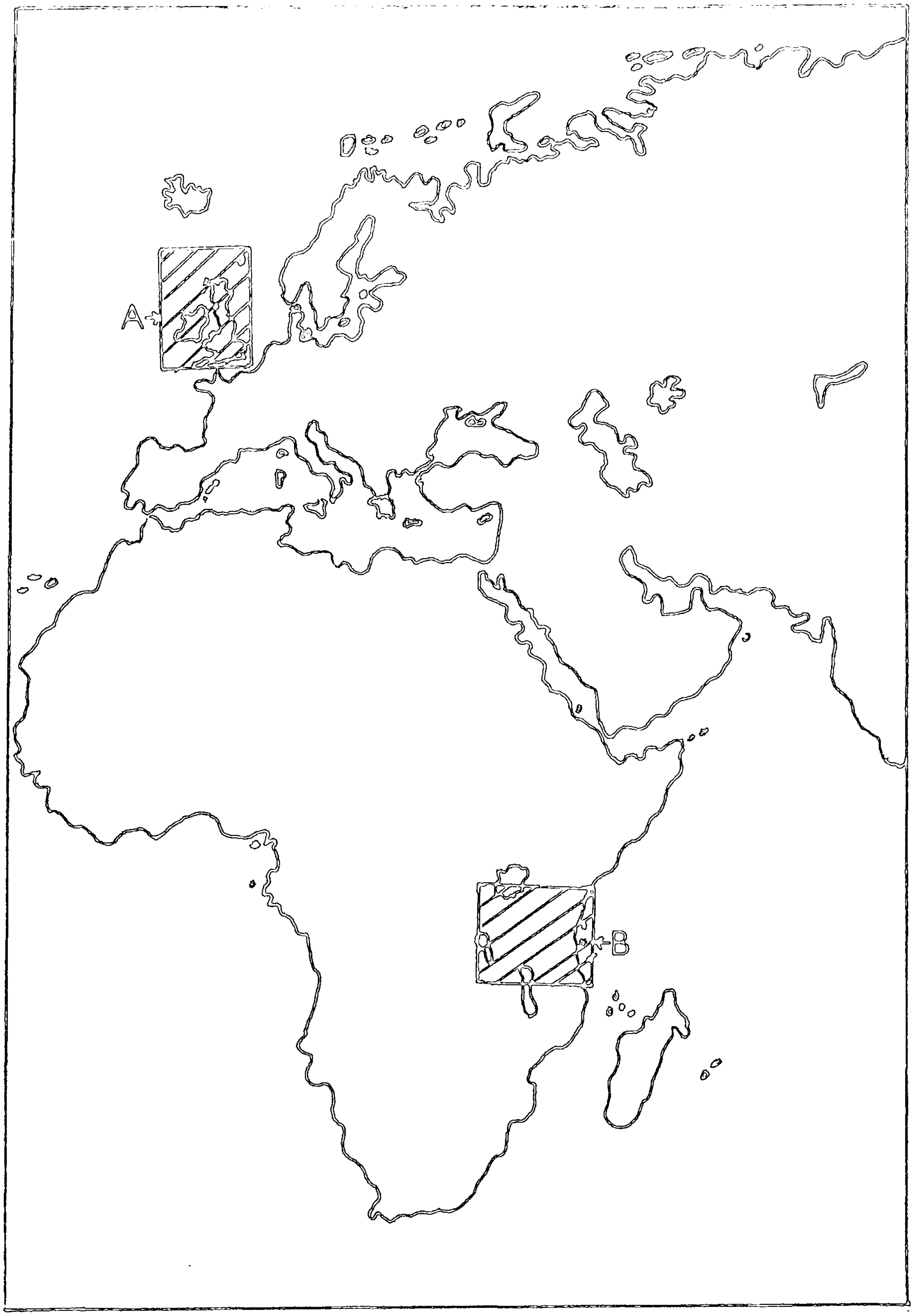


Figure 2.1 - The two regions from which the population samples are drawn.

A = Great Britain

B = Tanzania

Figure 2.2 Map of Tanzania

actual locations where photographs of subjects were taken are shown in Table 2.1. Fig. 2.2 is a map of Tanzania which shows some of the locations. Fig. 2.3 and 2.4 are maps of the Southern Highlands region of Tanzania with locations of photographs shown on the latter figure also.

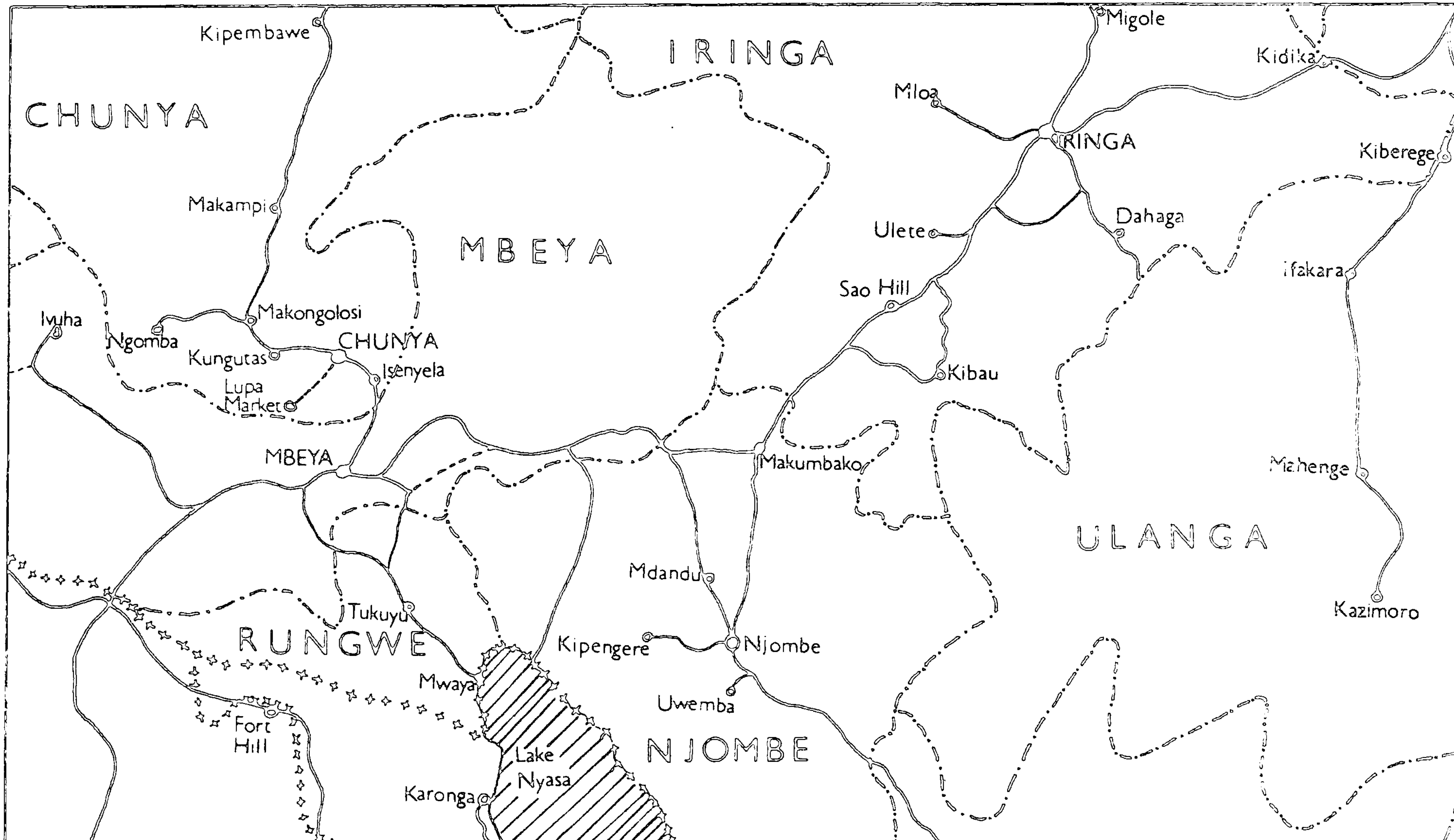
Table 2.1 - Locations of Photographs

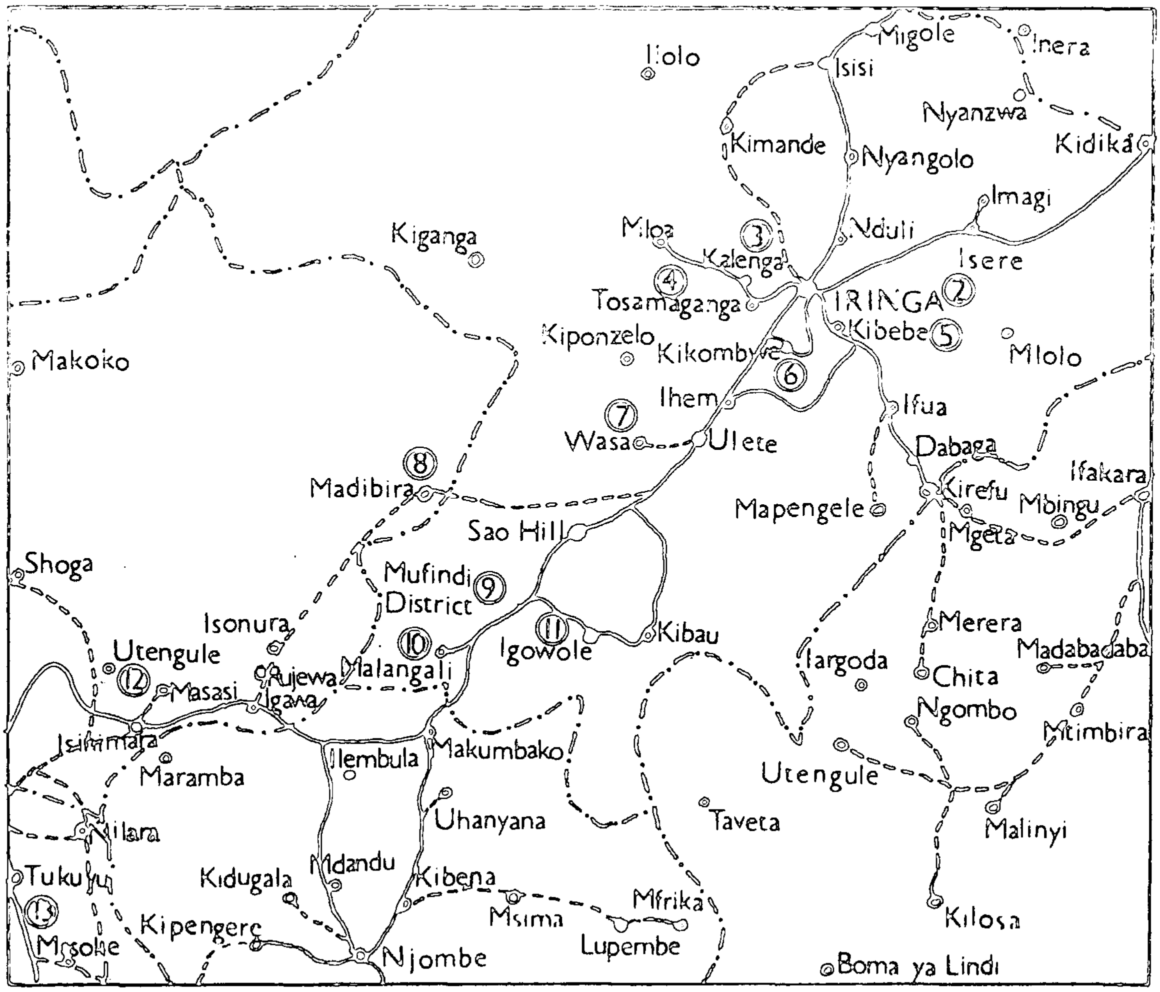
Place Name	Number on Map	
	Fig.2.2	Fig.2.4
Dodoma	1	-
Iringa Town	2	2
Kalenga	-	3
Tosamaganga	-	4
Kibebe	-	5
Kikombe	-	6
Wasa	-	7
Madibira	8	8
Mufindi District	-	9
Malangali	10	10
Igowole	-	11
Utengule, Usangu	-	12
Unyakyusa, Rungwe	-	13
Oruchinga	14	-
Mwanza	15	-

Each subject photographed was given a reference number and the subjects' tribe, sex and age range (i.e. adult or juvenile) was recorded. For most subjects the genealogical background, up to grand--parents birthplace or tribe, was also given.

From the first batch of photographs I decided that there were sufficient numbers of subjects to make up samples from five different tribes; Hehe, Nyakyusa, Sukuma, Tutsi and Kinga. There

Figure 2·3 Northern Lake Nyasa and Southern Highlands area.





<u>Fig. 2.4</u> Southern Highlands of Tanzania showing location of photographs

<u>Key to Figures 2.3 and 2.4</u>

———	Principal Roads
--------	Other roads and tracks
+++++++	National boundries
-.-.-.-	Provincial boundries
	Water
○	Main towns
◎	Villages
◯	Photographic location

were photographs of members of other tribes, e.g. Sangu and Twa, but the numbers were insufficient to make samples viable. On subsequent visits to Tanzania Dr. Redmayne increased the numbers of subjects of each of the five tribes named above.

The five tribes selected can immediately be divided into two groups; the Hehe, Nyakyusa and Kinga from Southern Tanzania; and the Sukuma and Tutsi from the North.

2.3 - Tribes from Southern Tanzania (Hehe, Nyakyusa and Kinga)

The Southern Tanzanian tribes include the Hehe, Nyakyusa and Kinga along with Bena, Sangu, Ntali, Pangwa, Ngonde, Kondo, Wanji and Safwa. Fig. 2.5 shows a tribal map of the Tanzanian part of Africa, whilst Fig 2.6 shows a magnified section around the North of Lake Nyasa and the Livingstone Mountains. Note that the large majority of the members of all tribes live, if not in their tribal territory itself (denoted by U prefix before tribal name i.e. Hehe - - tribe, Uhehe - tribal territory of Hehe) at least in areas which are more or less adjacent to it, so that each tribe tends to occupy a zone which centres on the tribal territory and overlaps to some extent with other similar areas occupied by adjacent tribes. Therefore, when looking at maps, the dividing lines between the areas occupied by one tribe and the next can only be drawn as an approximation and should be only regarded as such.

2.3 (i) Hehe

The Hehe inhabit the South Eastern region of Tanzania adjacent to the Zigula cluster of the coastal plateau and the Yao cluster of the central Bantu and may be regarded as intermediate between the two. The Hehe (Wahehe) along with the Chungwe (Zungwa) form the Rufifi cluster.

The Hehe inhabit the province of Iringa, the political

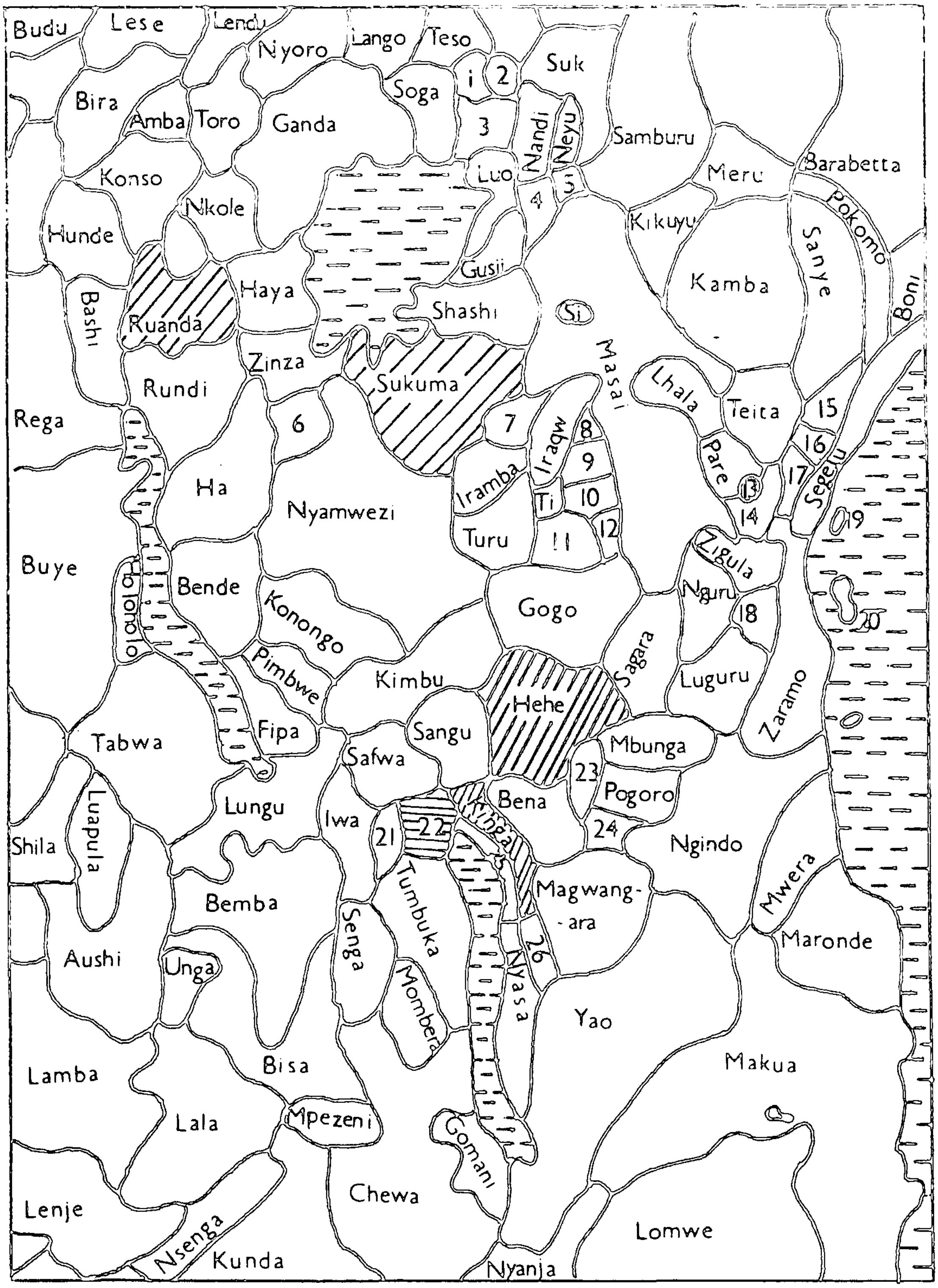


Figure 2.5 Tribal map of East Africa showing approximate territorial boundries of tribes (from Murdoch, 1959)
(Tribes in this study are stippled)

Key
1. Gisu
2. Sabei
3. Wanga
4. Nipsigi
5. Dordao
6. Sumbwa
7. Kindiga
8. Kindigo
9. Coroa
10. Rangi
11. Sandawi
12. Burungi
13. Mu
14. Shambala
15. Giryama
16. Segaju
17. Digo
18. Kwere
19. Pemba
20. Hadimu
21. Lambya
22. Nyakyusa
23. Noamba
24. Matambi
25. Kusi
26. Matengo

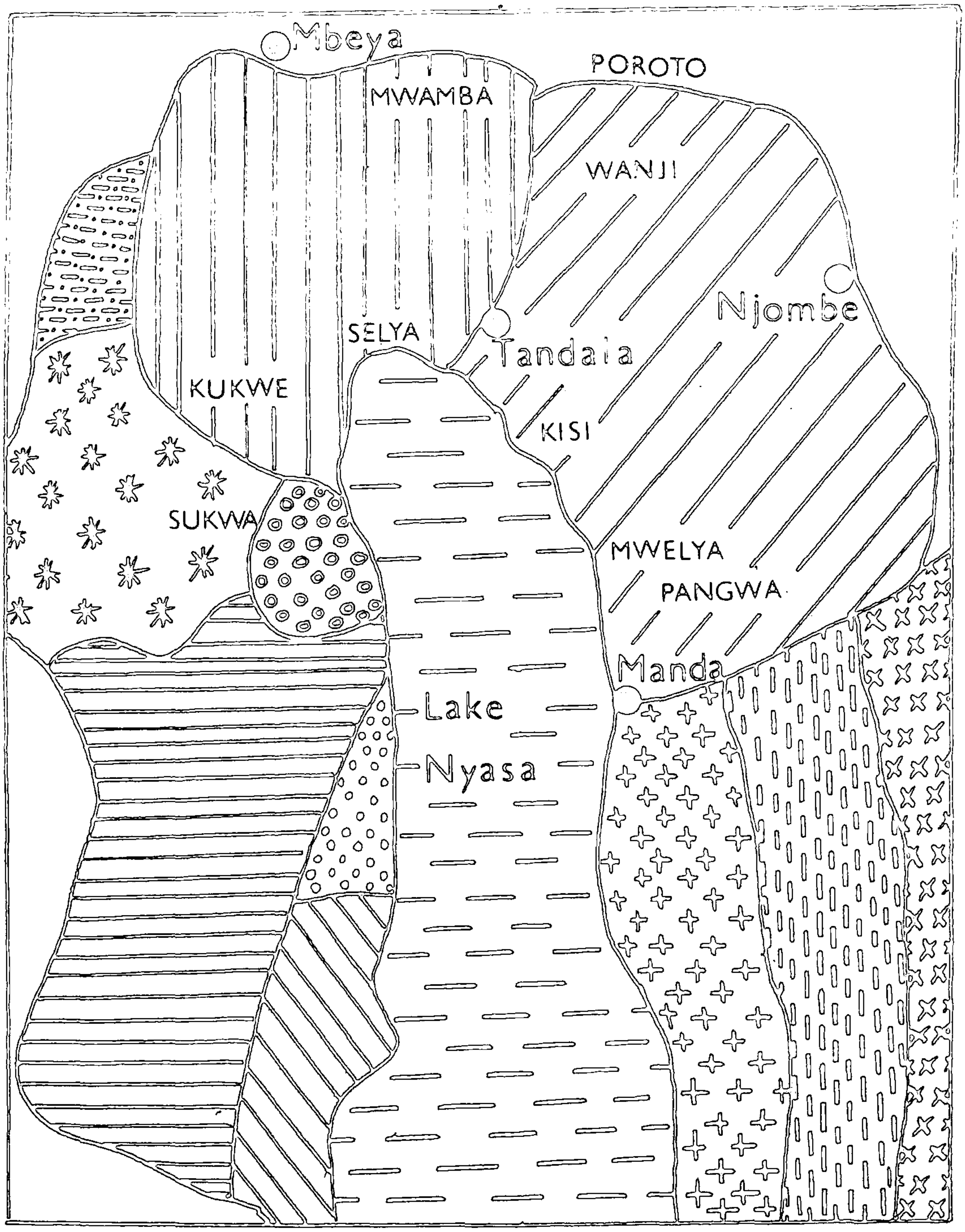


Figure 2.6 North Nyasa Region showing Tribal Territories

Key

Nyakyusa
Kinga
Ndali
Lambya
Ngonde
Ngoni
Sisya
Chewa
Nyasa
Matengo
Magwangara

capital of Uhehe being Kalenga. The Hehe are of historically mixed origin within the last 100 - 150 years and there is, therefore a great variety among them. Within the tribe there is also a great amount of cross-cousin marriage although close relations have been excluded in this study using the genealogical data collected. Wherever possible Hehe with four Hehe grandparents have been selected. Photo--graphs were taken in Uhehe at Kalenga, Iringa, Wasa, Tosamaganga, Kibebe, Malangali, Mufindi and Igowole (see Fig 2.4).

2.3(ii) Nyakyusa

The Nyakyusa and Kinga inhabit the region further South and West from the Hehe. Along with the Ngonde and Sangu the Nyakyusa and Kinga from the Nyasa cluster around the Northern Shores of Lake Nyasa (see Fig. 2.6). By tradition the Nyakyusa and Kinga are offshoots of the same stock and share a common border.

Nyakyusa country is bounded on the south by Lake Nyasa and the Songwe River, on the east by the wall of the Livingstone range and on the west by the Ndali Hills. It is thickly populated in the south around the Lake-Shore plain but in recent years there has been a large movement of Nyakyusa from Rungwe district (Unyakyusa) into Mbeya district to the areas east and west of Mbeya town. The Nyakyusa (Niakiusa, Sochile, Sokile) along with the Ngonde or Konde, which is modern classification are the same, are primarily cattle rearers and banana - cultivators. They practice subsistence agriculture by intensive cultivation with rotation of crops. As widely shifting cultivation is not practiced, villages are relatively stable. Nyakyusa traditionally reveal a highly distinctive form of social organization that of age - villages. Each age - village consists of a male age - group with wives of any age and children. Nyakyusa speak a language common with the Ngonde and called Nyakyusa which is one of the five main Bantu tongues. Since the Kinga and Nyakyusa share a common border there have been many intermarriages and, therefore, the two tribes are now comparatively mixed. Godfrey and Monica Wilson have lived with and written much about the Nyakyusa (see Wilson, M., 1949, 1951, 1957, 1959 and Wilson, G., 1936, 1951).

2.3(iii) Kinga

The Kinga along with the Mahesi, Mwelya, Pangwa and Wanji inhabit the Livingstone mountains north-east of Lake Nyasa. They live in Njombe district although there has now been some migration of Kinga into Uhehe where many have now settled and work for the Tea Company. The Kinga inhabit the inaccessible heights of the north and west portions of the Livingstone mountains which rise to 10,000 feet. They are agricultivalists living in scattered homesteads, cultivating wheat, peas, potatoes along with oats and barley. They own moderate numbers of cattle and many sheep and goats. On average the Kinga are shorter in stature than the Hehe or Nyakyusa. Socially the Kinga were chased up into the cold mountains and are thought of as servile while being extremely hard working in adverse weather conditions.

2.4 - Tribes of the Northern Region of Tanzania (Sukuma, Tutsi)

2.4(i) Sukuma

The Sukuma, a word which means 'North' or 'Northmen' live in the northern part of Tanzania, south of Lake Victoria around Mwanza. The tribal area of Usukuma is shown in the map, Fig. 2.7, but, as explained before, this area is only approximate and significant numbers of Sukuma are found in Geita, Kwimba, Maswa, Mwanza, Musoma, Shinyanga, Kahama, Nzega and Tabora districts. This whole area is called Greater Unyamwezi and Sukumu along with Nyamwezi, Kimbu, Konongo and Sumbwa form the Nyamwezi cluster (see Figs. 2.7 and 2.5). The Sukuma is the largest tribe in Tanzania and Nyamwezi is the second largest.

Although the Sukuma live in Tanzania they are culturally and

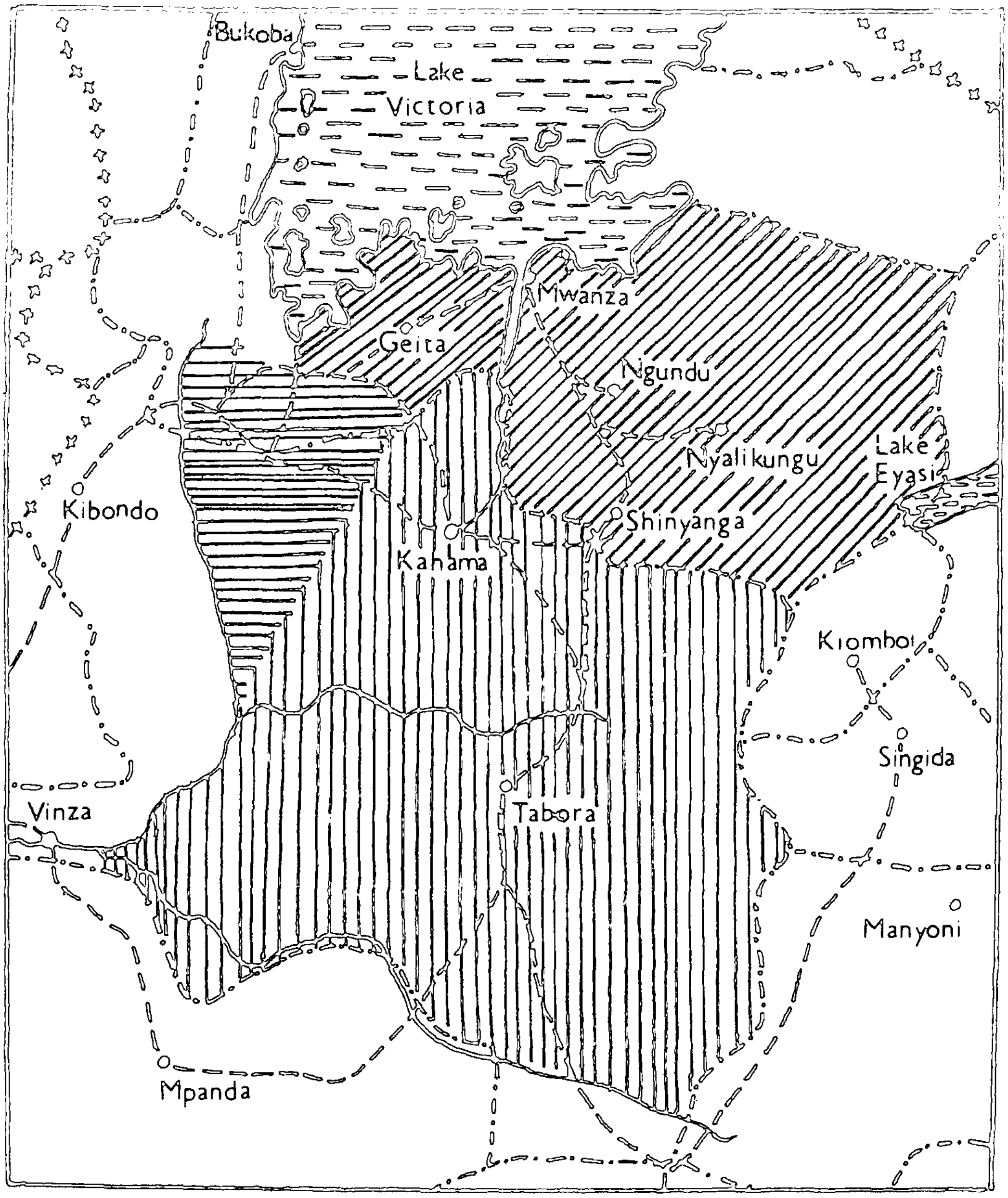


Figure 2.7 Greater Nyamwezi (from Ethnographic Survey of Africa, 1967)

Key

Main Roads

Rivers

International Boundries

Provincial Boundries

USUKUMA

USUMBWA

UNYAMWEZI

linguistically more like the Ugandan peoples from the interlacustine area in and around Lakes Edward, Albort and Victoria. They are more akin to the Ugandan Bantu speaking peoples e.g. Ganda, Chiga (Kiga), Nkole, Nyoro, Toro etc. (see Fig. 2.5) than to the tribes of the Southern Highlands region.

Most Sukuma were photographed around Mwanza but some were school boys posted from one end of the country to the other during school reorganization in the 1970's. These were photographed at Iringa Town and at Tosamaganga and Malangali schools (see Fig. 2.4). In the last few years the real bush Sukuma have trekked south hundreds of miles for grazing in Usangu. They are not integrated among the Sangu and when they appear in the south they still cling to their bush Sukuma dress and so are readily identifiable and indeed stand out because of these noticeable differences. Some of these were photo--graphed around Utengule,Usangu (see Fig. 2.4).

2.4(ii) Tutsi

The Tutsi were refugees from Rwanda and are quite different from any of the other tribes. They were the former ruling class of Rwanda and now are to be found not only there but in parts of Uganda (Nkole aristocrats, Nyoro as Bahima etc.), in Burundi as Haya, Ha etc., and in Tanzania west of Lake Victoria where they are more dispersed and mix a little with the Nyamwezi. The Tutsi in this study were photo--graphed at Oruchinga which is four miles from the Tanzanian border, just inside Uganda (see Fig. 2.2).

The Tutsi are tall, linear, acquiline with generally narrow build and have an aristocratic bearing. Their features are associated with Erythriote (Eastern Hamitic) stock and as such they appear atypical of the people living in the Nyamwezi cluster (see d'Hertefelt et al., 1962; d'Hertefelt, 1951; Heusch, 1966).

2.5 - Numbers of Individuals in Samples from Tanzania

In addition to the photographs supplied by Dr. Redmayne I increased the numbers by using photographs taken by Dr. F. Fülleborn in the Southern Highlands. His photographs yielded 11 extra Hehe male adults, 13 extra Nyakyusa male adults and 4 female adults, and 2 extra Kinga male adults along with 1 female adult.

The numbers of individuals in each of the samples of the tribes is shown in Figure 2.8.

Figure 2.8 Structure of Tanzanian Sample

CATAGORY	TRIBES					All Tribes
	Hehe	Sukuma	Nyakyusa	Kinga	Tutsi	
Male Adults	112	49	84	20	11	276
Female Adults	63	0	4	4	16	87
Male Juveniles	32	0	0	2	8	42
Female Juveniles	31	0	0	0	4	35
Total for Tribe	237	49	88	26	39	440

The largest sample was of Hehe and all four categories of age and sex were available for comparison. Similarly all the tribes, with the exception of the Tutsi, had a viable sample of male adults so that comparisons could be made; the Tutsi were also used even though the number was small. The total sample numbered 440 individuals which included 276 male adults and 87 female adults, these could be compared to the British Isles sample.

2.6 - The British Isles Sample

Photographs were taken of staff and students at Surrey University, University of Durham, Farringdon School, Sundorland, and in Seaham, County Durham. In addition to the photograph each subject was given a reference number and asked to complete the questionnaire as shown in Fig. 2.9.

Figure 2.9 Questionnaire for British Subjects

Identification Number: ....

Age of Subject: ....

Sex of Subject: ....

Subject's birthplace:

City/Town/Village: ....

County/Country: ....

Subject's Father's birthplace:

City/Town/Village: ....

County/Country: ....

Subject's Mother's birthplace:

City/Town/Village: ....

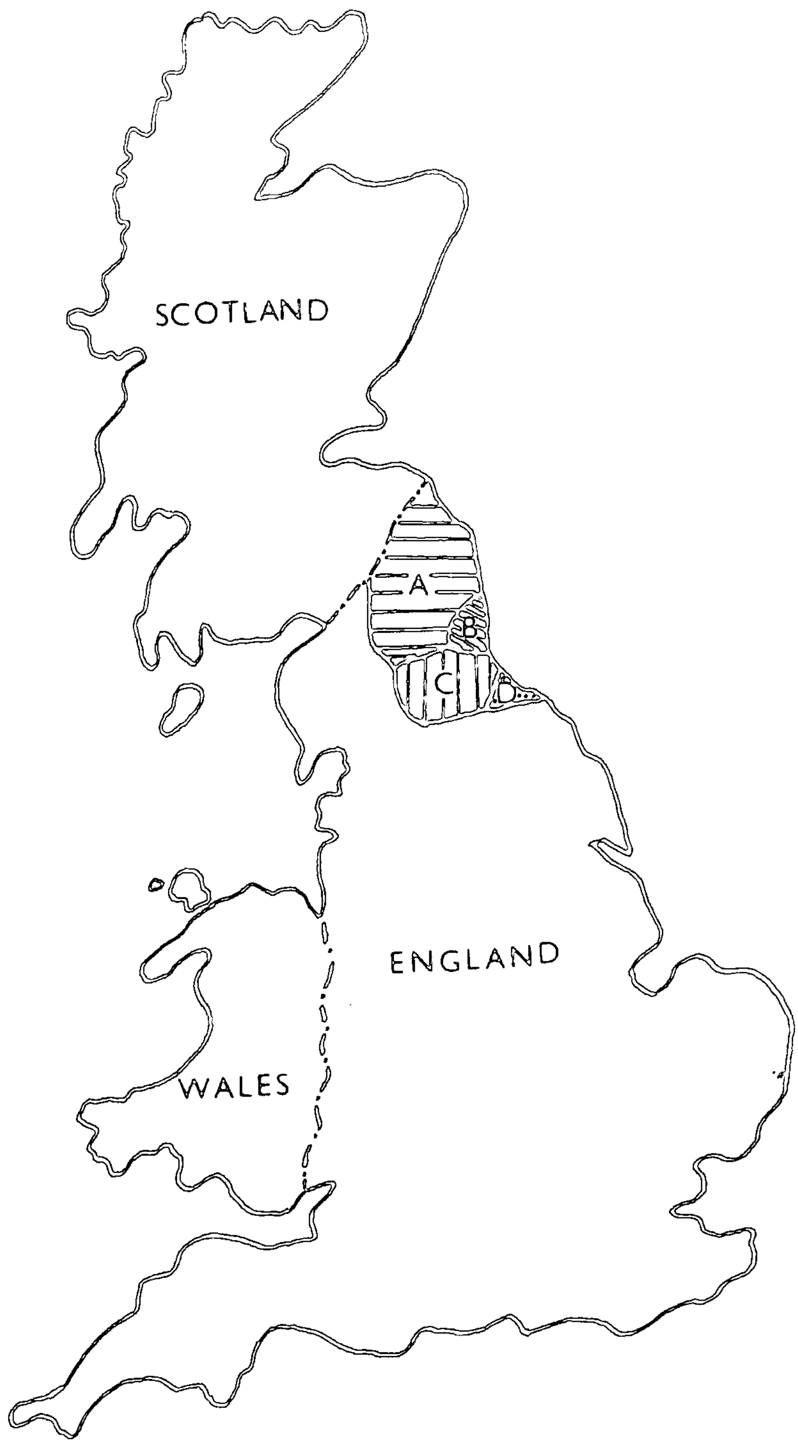
County/Country: ....

The subjects', Mothers' and Fathers' birthplaces were coded by county of the British Isles (see Appendix 1 for coding) and there were enough individuals who could be classed as "North - Easterners" to form a viable group. The criterion for being put in this group was that at least two out of three of the subjects birthplace, Mothers birthplace and Fathers birthplace were in the North - Eastern countries of Durham, Tyne and Wear, Northumberland and Cleveland or that the person had written North-East for 2 or 3/3.

The numbers of individuals in the British sample are shown in Fig. 2.10. Note that only adults were photographed in Britain. The counties constituting the North-East group as shown in Fig. 2.11.

As shown in Fig. 2.10 it is possible to compare males and females within Great Britain as a whole as well as comparing the North--East with the rest of Great Britain. The whole sample could also be compared with that from Tanzania.

Figure 2.11 England, Scotland and Wales showing the Counties of North-East England



A = Northumberland

B = Tyne and Wear

C = County Durham

D = Cleveland

Figure 2.10 The British Sample

CATEGORY	SAMPLE		
	North-East	Rest of G.B.	Great Britain
Male Adults	35	64	99
Female Adults	19	51	70
Totals	54	115	169

All of the genealogical information collected with reference numbers for the individuals in the Tanzanian and British samples were coded and entered on the computer data sheets (see Chapter 3) for entry into the Durham University Computer.

CHAPTER THREE - METHODOLOGY

3.1 - Introduction

The method of study used in this investigation is that of photogrammetry, a quantitative method of assessment derived from anthropometry. Instead of measurements being taken directly from the subject, however, photogrammetry involves measuring standardized photographs. Photogrammetry is an indirect method and, therefore, is sometimes called indirect anthropometry. To minimize error as much as possible the methods of taking, preparing and measuring the photo--graphs must be standardized.

In this chapter the methods employed in taking the standardized photographs are described in Section 3.2. This is followed, in Section 3.3, by an explanation of how the photographs were prepared for measurement. In Section 3.4 the landmarks of the face used as measuring points in this study are stated and defined. The next sections, 3.5 and 3.6, detail the measurements that are taken from frontal and lateral views respectively. Finally in Section 3.7 the techniques of measuring and recording results are described.

3.2 - Taking Standardized Photographs

Two photographs were taken of each subject, a frontal full--face view and a lateral profile view. As a guide to the methods used Weiner and Lourie (1969), Farkas (1981), Caven et al. (1952) and Morello et al. (1977) were used.

The subject was seated at a distance of three metres from the camera and a white background was placed two metres behind the subject's seat to avoid shadows. Natural light was used for the Tanzanian photographs but for the British series an indoor flash unit consisting of two lights, one to the side and back of the camera and a second closer to the lens of the camera were used so as to avoid shadow on the face (for a discussion of reliability of this photo--graphic technique see Chapter 4, Section 4.2). The subject was asked to remove spectacles and turn down high collars e.g. of polo-neck sweaters, the hair was to be brushed back from the forehead and left ear. Subjects were asked not to laugh or grimace. A 25cm. scale in centimetres was positioned next to the head in the frontal and profile views. This positioning was done carefully as shown in Figures 3.1 and 3.2 below. The frontal view was taken with the head in the Frank--furt plane the scale being positioned at the level of the outer corners of the eyes. This facilitated focusing, the plane of focus being approximately level with the lower orbital rim. The profile

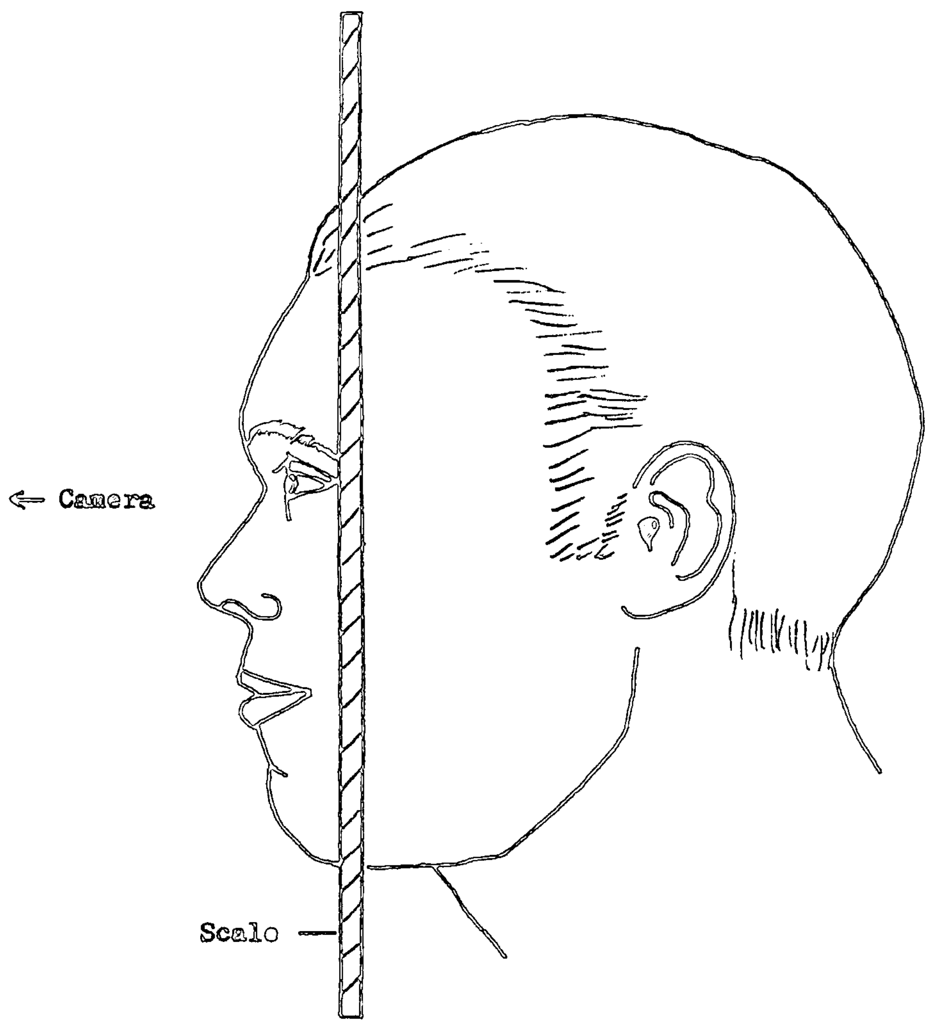
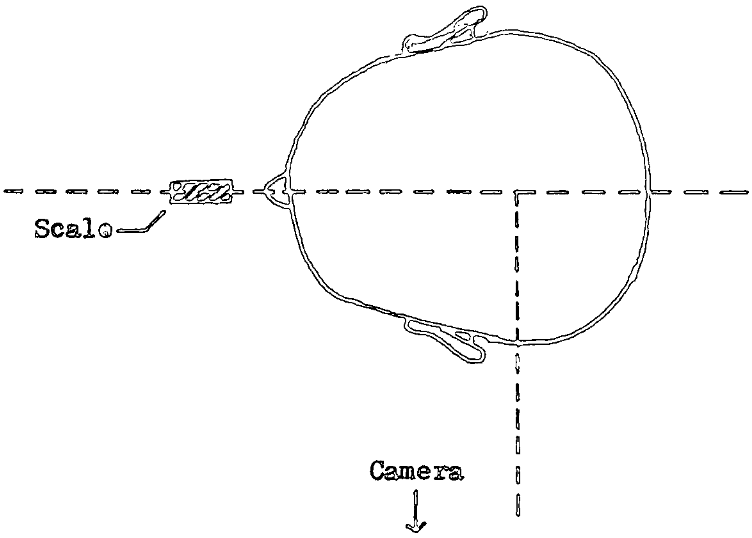


Figure 3.1 Positioning of Scale - Frontal View

photographs were taken with the scale positioned at the same plane as the tip of the nose. This helped to maintain the facial midline in the vertical. The scale was held in position with a clamp stand.

Figure 3.2 Positioning of Scale - Lateral View



In the lateral view the left side of the face was always photographed with the medial sagittal plane vertical. Each subject was photographed frontal view first, lateral view second. The camera was focused onto the scale in each case. A card bearing a reference number for each subject was held up in the frontal view only. Great care was taken in positioning the face relative to the camera, scale and lighting.

3.3 - Preparing the Photographs for Measurement

The Tanzanian series of photographs were supplied as black and white transparancies. These were projected onto a screen which was made of hardwood. Clips were fixed on the screen so that a piece of drawing paper could be held flat on its surface. The screen and projector were carefully positioned in the same horizontal plane and a convenient lens-screen distance was found and maintained so that a large image appeared on the drawing paper. This was carefully drawn round using a sharp pencil and the scale divisions were marked (method employed by Brothwell and Harvey, 1965).

The British series of photographs were supplied as large 7" X 5" prints. The measurements were simply made directly from these prints.

3.4 - Landmarks of the Head and Face used in this Investigation

Before any measurement of distances or angles can be carried out, the various landmarks (measuring points) to be used must be defined as precisely as possible so as to ensure standardization of identification and location of these landmarks on the photographs. It is to and from these landmarks, or in some cases horizontal or verti--cal projections of them, that measurements are taken.

In this study classical anthropometric landmarks are used, although, in certain cases adaptations for photogrammetry have to be made. The landmarks are named using Greek or Latin anatomical terminology and are denoted by lower case lettering as is standard anatomical and anthropometrical practice. Photogrammetry, however, is indirect anthropometry adapted for the quantification of surface features and so the landmarks used in photogrammetry reflect this change in methodology. Consequently, the landmarks used in photo--grammetry may bear the same name as those used in anthropometry and yet may not have precisely the same anatomical location. This corresponds to the differences in the precise location of measuring points used in cephalometry as opposed to craniofacial anthropometry.

Some anthropometrical landmarks may be described by the adjectives "bony" or "osseous" when they are located on the surface of the bone and are identified by palpation; others are termed "soft" where they are located on the skin surface. Facial photogrammetry, because it is an indirect method of measuring and because it relies upon features visible on the soft facial tissue, uses almost entirely soft landmarks. The measuring points used in this study are, therefore, a combination of soft landmarks used in anthropometry of the face and others which can be best described as being soft photogrammetric substitutes for the bony anthropometric landmarks. These substitute landmarks are located on the skin surface over the bone and soft facial tissue and are thus in close proximity to the bony landmarks which they replace. In addition some landmarks used in this photogrammetric investigation depend upon the position of the head in the photograph in relation to the vertical or horizontal.

The landmarks used in this study are shown in Figures 3.3 and 3.4 and are listed in Table 3.1 which also indicated whether they are obtained from frontal and/or profile views. The definitions which follow give the precise location of the landmark and its relationship to other landmarks of the same name used in cephalometry or cranio--facial anthropometry. The particular landmarks used in this investigation were chosen because of degree of visibility in the photographs, ease of identification and reliability of location. For a discussion on the reliability of location of landmarks see Chapter 4.

The references used to compile these landmarks are; Martin and Saller (1957), Brothwell and Harvey (1965), Farkas (1981), Ashley--Montagu (1935) and (1939), Gosman (1950), Howells (1937), Jones (1929) and Hrdlicka (1920).

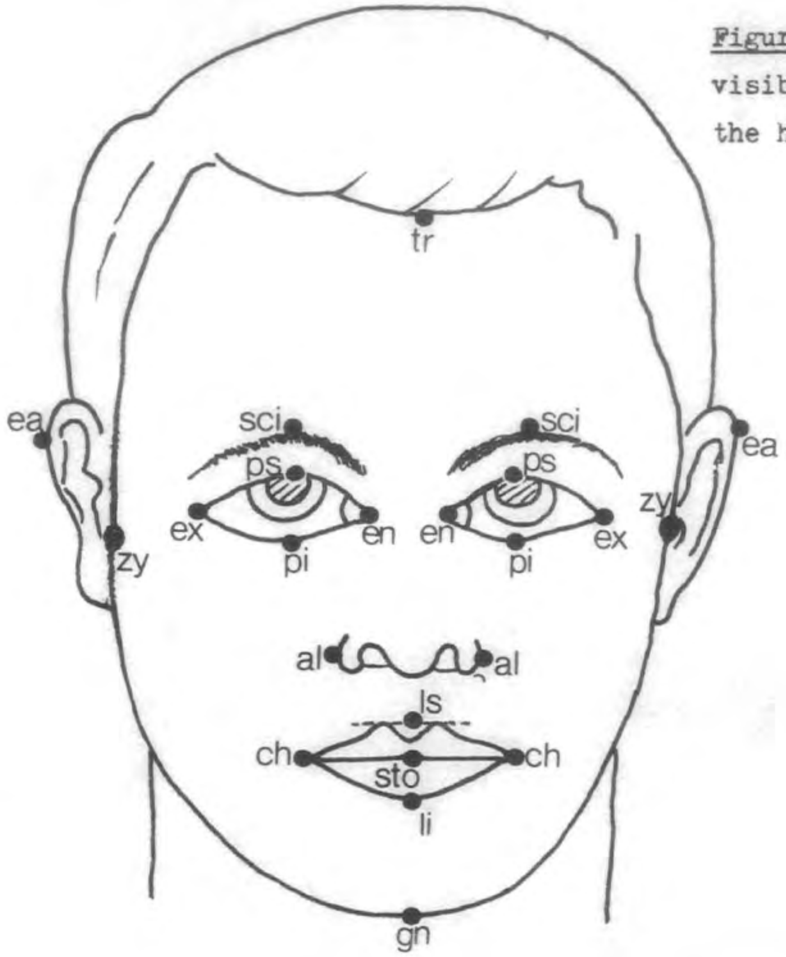


Figure 3.3 Landmarks visible on frontal view of the head and face

Figure 3.4 Landmarks visible on the profile view of the face

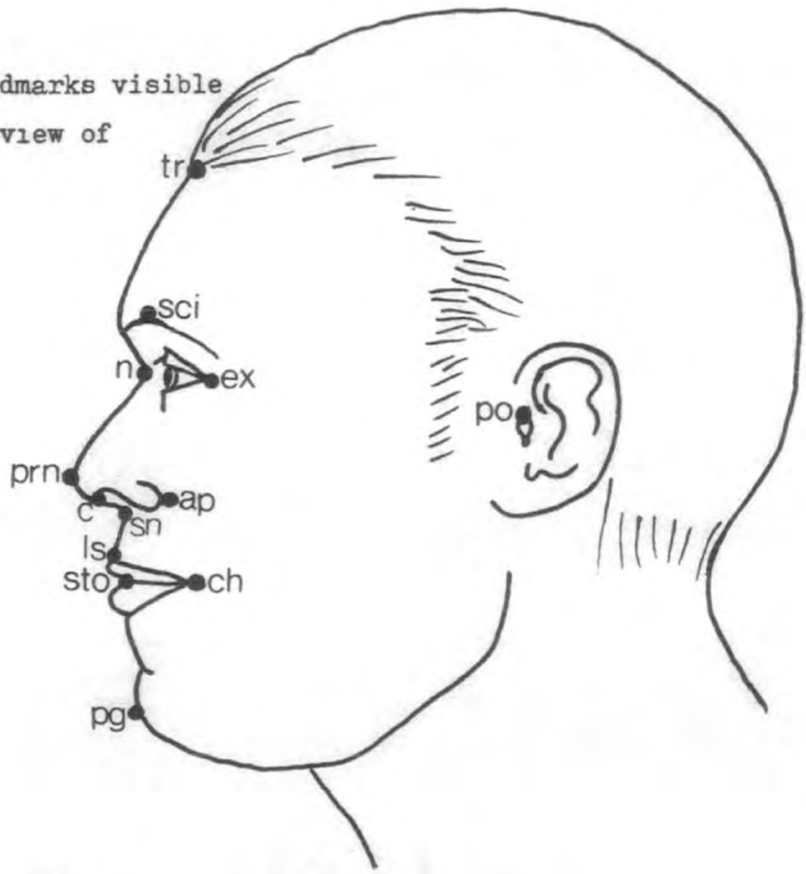


Figure 3.5 Landmarks of Right Orbit

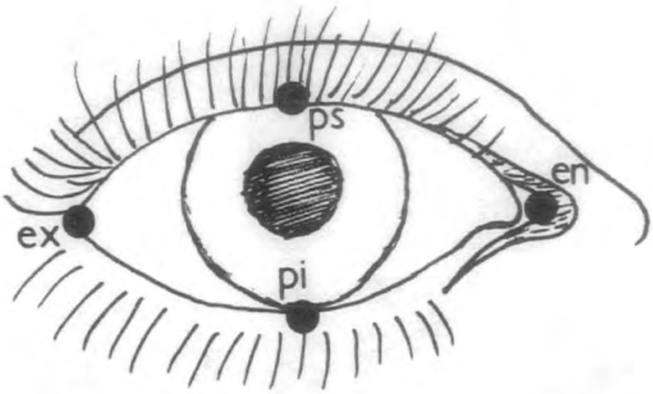
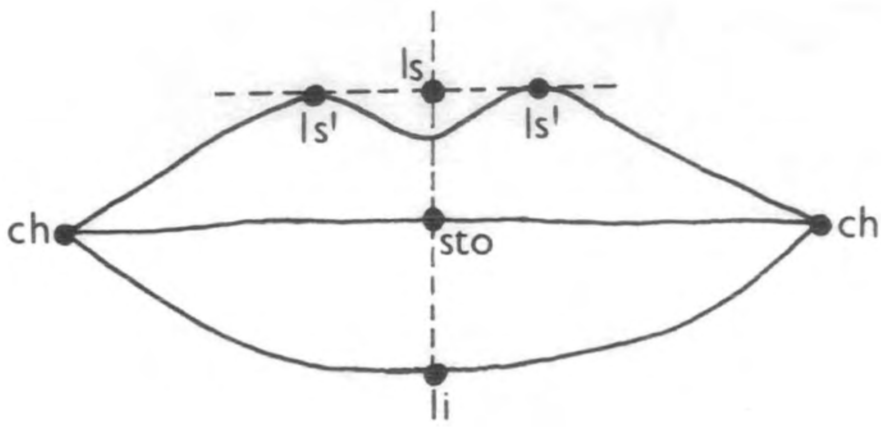


Figure 3.6 Landmarks of the lips and mouth



Landmarks used in this study

Where landmarks were available for taking measurements in both frontal and profile views - the profile landmark was chosen in preference because it was more reliable.

Table 3.1 - Landmarks used

REGION	LANDMARK	VIEW FROM WHICH TAKEN
HEAD	Trichion (tr)	Profile
FACE	Zygion (zy) Pogonion (pg) Gnathion (gn)	Front Profile Profile
ORBITS	Endocanthion (en) Exocanthion (ex) Palpebrale superius (ps) Palpebrale inferius (pi) Superciliare (sci)	Front Front and Profile Front Front and profile Profile
NOSE	Nasion (n) Alare (al) Pronasale (prn) Subnasale (sn) Columella high point (c) Alar posterior point (ap)	Profile Front Profile Profile Profile Profile
LIPS AND MOUTH	Labiale superius (ls) Labiale inferius (li) Stomion (sto) Cheilion (ch)	Front and profile Front Front and profile Front
EARS	Porion (po) Exaurale (ea)	Profile Front

Definitions of Landmarks

Head

Trichion (tr) is the point on the hairline in the midline of the forehead (Fig. 3.3 and 3.4).

Face

Zygion (zy) this is the most lateral point on the skin surface covering each zygomatic arch. It is the soft landmark over the bony zygion of the malar bones (Fig. 3.3).

Pogonion (pg) is the most anterior midpoint of the chin located on the skin surfaco in front of the bony pogonion of the mandible (Fig. 3.4).

Gnathion (gn) this is the lowest median landmark on the lower border of the mandible. It is located on the skin surface covering the bony landmark of the mandible. In some texts the gnathion is called the menton (Figs. 3.3 and 3.4).

Orbits

Endocanthion (en) is the point at the inner commissure of the eye fissure. This soft endocanthion is located laterally to the bony landmark used in cephalometry (Figs.3.3 and 3.5).

Exocanthion (ex) sometimes known as ectocanthion it is the point at the outer commissure of the eye fissure. The soft exocanthion is slightly medial to the bony exocathion (Figs. 3.3, 3.4 and 3.5).

Palpebrale superius (ps) is the highest point in the midportion of the free margin of each upper eyelid when they are in the normal rest position (Fig. 3.5).

Palpebrale inferius (pi) is the lowest point in the midportion of the free margin of each lower eyelid (Fig. 3.5).

Superciliare (sci) is the highest point on the upper borderline in midportion of each eyebrow (Figs. 3.3 and 3.4). When the eyebrows have been plucked the superciliare cannot be located.

Nose

Nasion (n) this is the point in the midline of both the nasal root and the nasofrontal suture. The nasion can be identified by a slight ridge and is always above the line that connects the two endocanthi (Fig. 3.4). The soft nasion and the bony nasion are identical. (Ashley-Montagu 1935).

Alare (al) is the most lateral point on each alar contour (Fig. 3.3).

Pronasale (prn) is the most anterior point of the nasal tip (Figs. 3.4 and 3.7).

Subnasale (sn) is the midpoint of the columella base at the apex of the angle where the lower border of the nasal septum and the surface of the upper lip meet (Figs. 3.4 and 3.7). This point is not identical to the bony sub-nasion, or nasospinale, used in cephalometry.

Highest point of the Columella (c) is the point on each columella crest, level with the top of the corresponding nostril (Figs. 3.4 and 3.7).

Alar Posterior Point (ap) most posterior margin of the nasal wings in profile view (Fig. 3.4).

Lips and Mouth

Labiale superius (ls) is the highest point in the midportion of the upper vermilion line (Figs. 3.3, 3.4, and 3.6).

Labiale inferius (li) is the lowest point in the midportion of the lower vermilion line (Figs. 3.3 and 3.6).

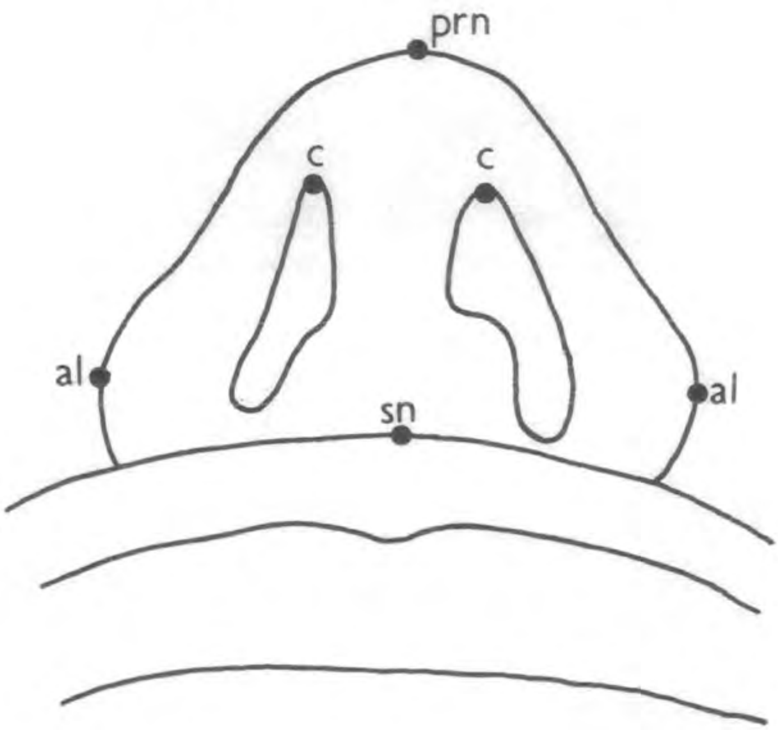
Stomion (sto) is the imaginary point at the crossing of the vertical facial midline and the horizontal labial fissure between gently closed lips with teeth shut in the natural resting position (Figs. 3.3, 3.4 and 3.6).

Cheilion (ch) is the point located at each labial commissure and is thus the most lateral point on each side of the mouth (Figs. 3.3, 3.4 and 3.6).

<u>Ears</u>

Porion (po) is the highest point on the upper margin of the cutan--eous auditory meatus (Fig. 3.4). This soft landmark is a few millimetres medial to the bony porion (Ashley--Montagu, 1939). The term auriculo has been used to represent the soft porion and differentiate it from the bony porion (Hrdlicka, 1920 and Gosman, 1950).

Exaurale (ea) the most lateral point on the free margin of the external auricle or pinna (Fig. 3.3)

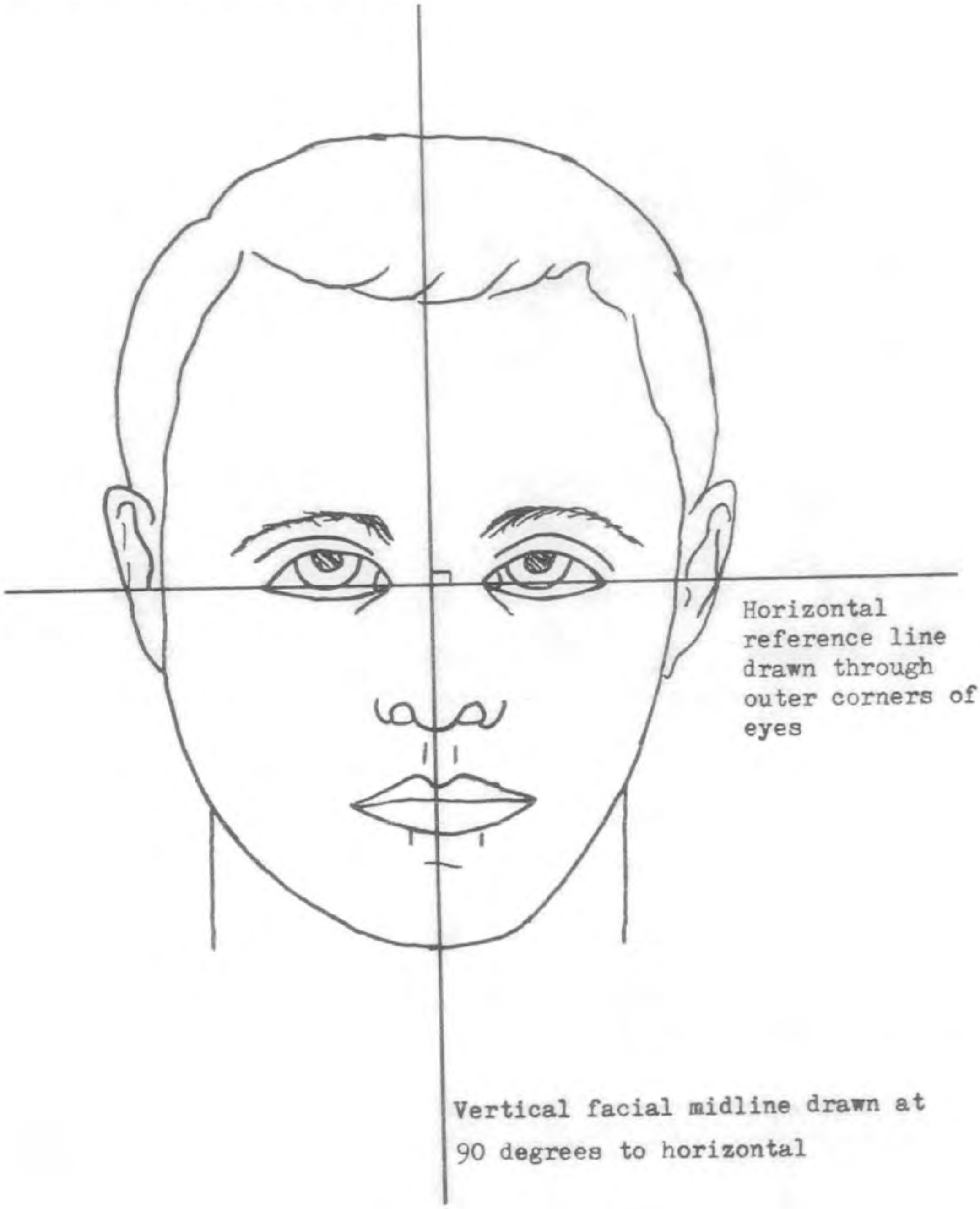


<u>Figure 3.7</u> View of base of nose to show relationship of landmarks to each other (N.B. this view is not used for measurement in this investigation).

3.5 - Measurements taken - Frontal (Full-face) View

Before any measurements were taken the head was first orientated horizontally (Brothwell and Harvey, 1965). This was done using the outer corners of the eyes through which a horizontal axis is then drawn. Next a vertical line is drawn at right angles to the first line and this line is drawn down the centre of the face so

Figure 3.8 Orientation of Front View



forming the vertical facial midline. The landmarks are then located and marked on the photographs. Measurements can then be taken vertically or horizontally using the two lines already drawn as reference lines (see Fig. 3.8).

3.5(i) - Horizontal Measurements

(Numbers refer to Fig. 3.9) All measurements in horizontal plane.

1. Bizygomatic Diameter (zy - zy) the horizontal distance between the zygomatic arches. This is the maximum horizontal breadth of the face (Fig. 3.9).

2. Biaural Breadth (ea - ea) the maximum horizontal breadth between the most lateral margins of the outer ear (Fig. 3.9).

3. Nasal Breadth (al - al) distance across the nostrils at their widest point (i.e. from alar crst to alar crest), (Fig. 3.9). This measurement is sometimes called the bi-alar diameter.

4. Inter - occular Distance (en - en) the distance between the inner corners of the eyes (Fig. 3.9).

5. Bioccular Diameter (ex - ex) distance between the outer corners of the eyes (Fig. 3.9).

6. Mouth Width (ch - ch) distance between the outer corners (cheilions) of the mouth when lips are "at rest" (Fig. 3.9). This measurement is sometimes called the labial fissure length.

3.5(ii) - Vertical Measurements

(Numbers refer to Fig. 3.10) All measurements in vertical plane.

7. Upper Lip Height (ls - sto) vertical distance from highest point of upper vermilion line (ls) to stomion. This is the cutaneous upper lip only (Fig. 3.10).

8. Lower Lip Height (sto - li) vertical distance from lowest point of lower lip (li) to stomion (Fig 3.10).

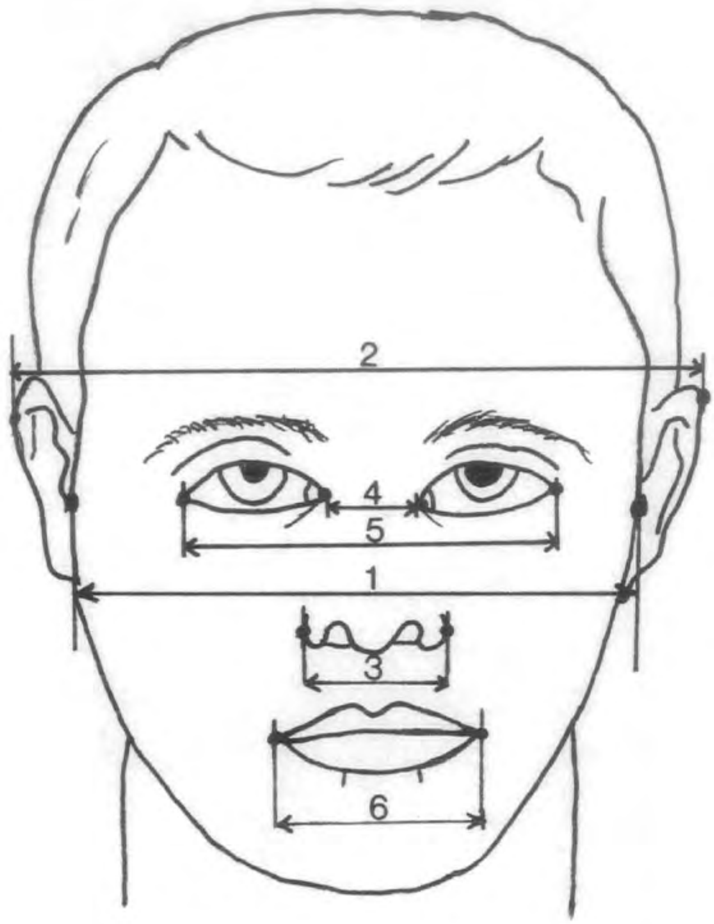


Figure 3.9 Horizontal Measurements Frontal View

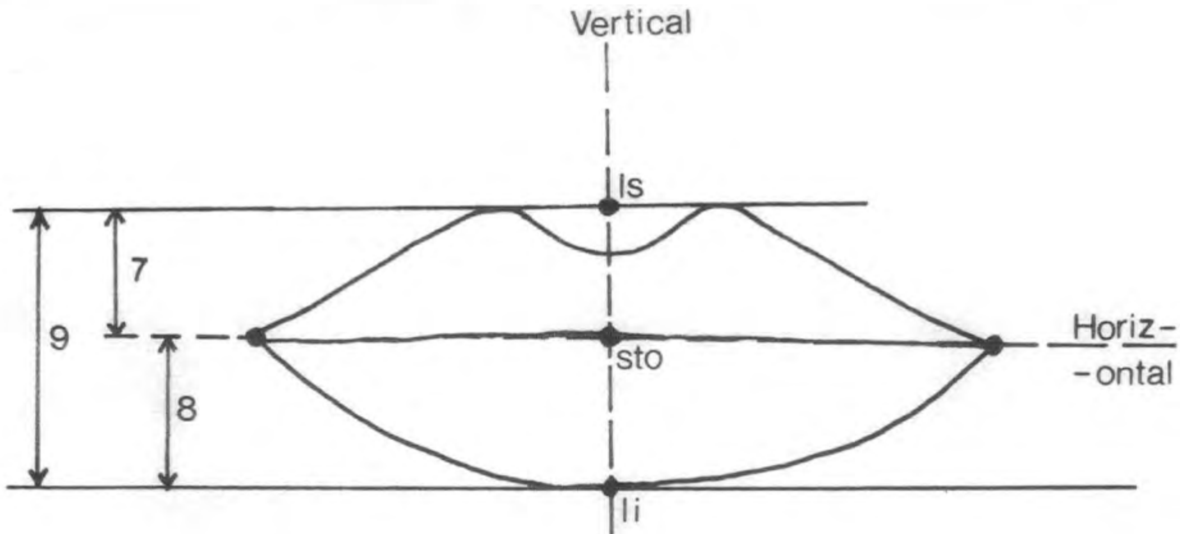


Figure 3.10 Vertical Measurements Frontal View

9. Total Height of Lips (ls - li) vertical distance from lowest to highest points of lips. Measurements 7 and 8 above (see Fig. 3.10).

3.5(iii) - Other Measurements taken from Frontal View

The measurement of the eye fissures cannot be classed either as horizontal or vertical since the fissures run at an angle to the horizontal mid - facial line. This inclination of the eye - -fissures to the horizontal is sometimes measured in anthropometry of the face or scored in anthroscopy (Farkas, 1981).

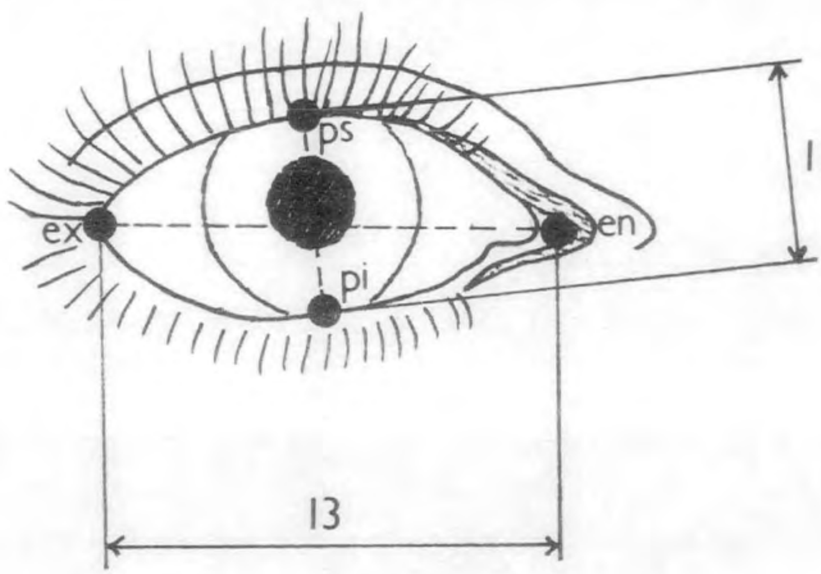
10. Right Eye Fissure Height (ps - pi) distance between the palpebrale superior and palpebrale inferior i.e. the greatest distance between the free edges of each eyelid (Fig. - - 3.11).

11. Left Eye Fissure Height (ps - pi) as for right eye.

12. Right Eye Fissure Width (en - ex) distance between the endocan- -thion and the exocanthion of the right eye (Fig. 3.11).

13. Left Eye Fissure Width (eu - ex) as for right eye.

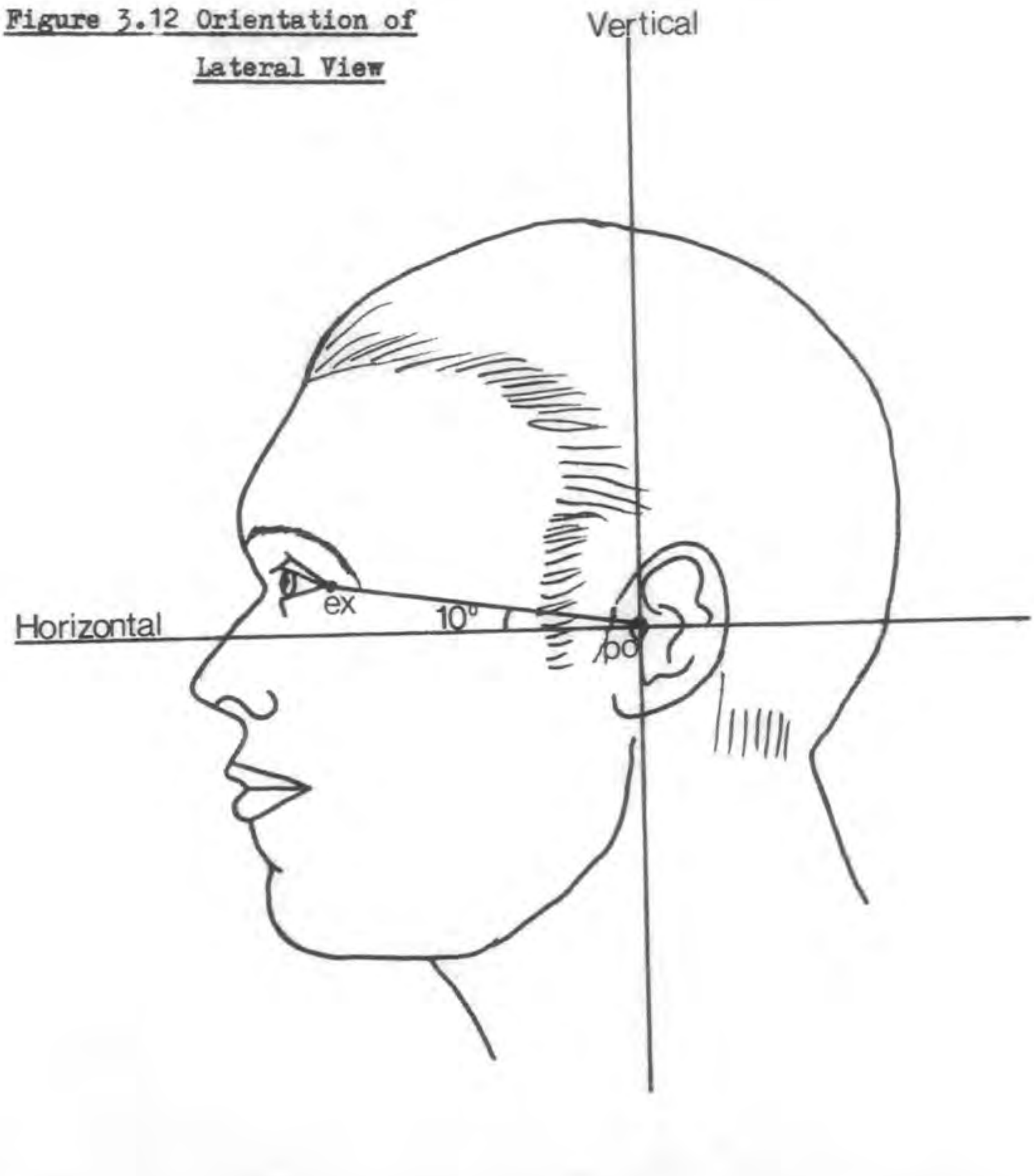
Figure 3.11 Measurements of Right Eye



3.6 - Measurements taken from Lateral (profile) View

As for the frontal view the head in the lateral view has first to be orientated horizontally prior to any measurements being taken. The method used for this was developed by Brothwell and Harvey, 1965. They found by experiment that a line drawn at 10 degrees to the horizontal passed, respectively, through the upper margin of the external auditory meatus and the outer corner of the eye orientated the head in a position closely corresponding to the natural carrying position. Therefore, a line is drawn linking the porion and exocan--thion on the profile view photograph and the the 'horizontal' can be constructed at 10 degrees to the po - ex line. The vertical axis is then drawn at 90 degrees to the horizontal and these two lines provide

Figure 3.12 Orientation of Lateral View



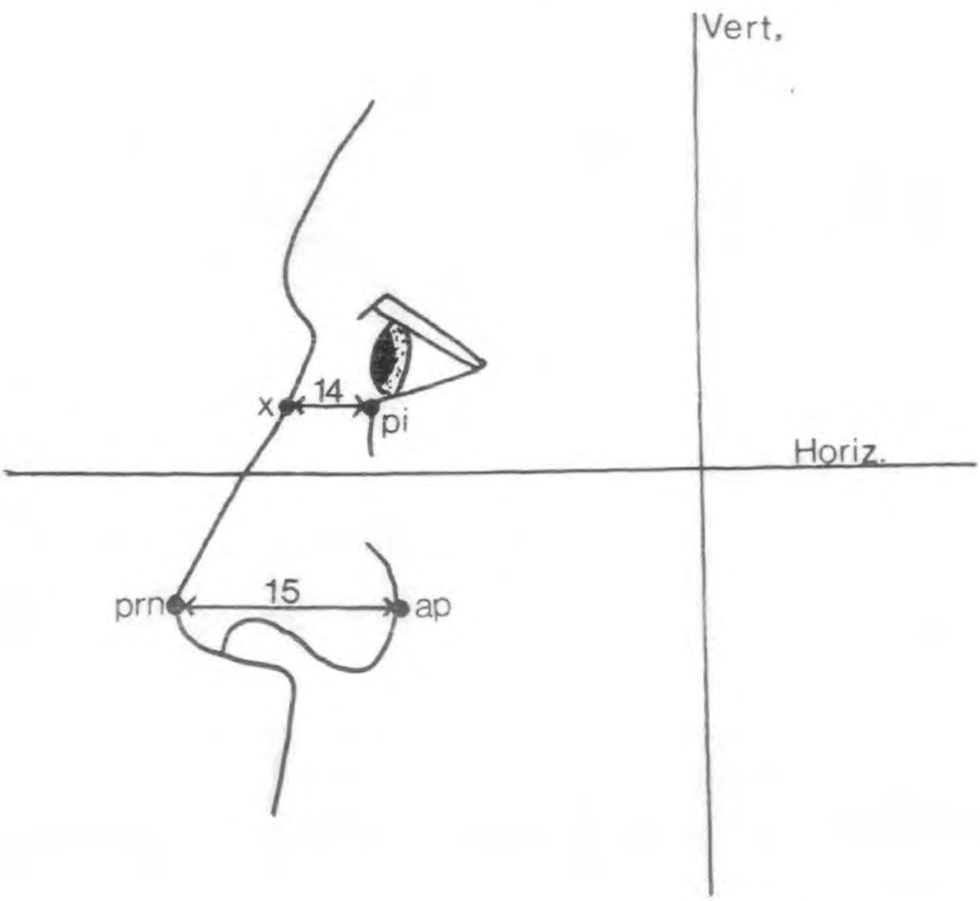
the reference lines for measurements taken in the vertical or horizontal planes (see Fig. 3.12).

3.6(i) - Horizontal Measurements taken from Profile View

14. Nasal Prominence (prn - ap) horizontal distance between the most posterior margin of the nasal wing (ap) and the most anterior point of the nasal tip (prn),(Fig. 3.13).

15. Nasal Bridge Distance - horizontal distance between the outer margin of the lower eyelid (pi) and the nasal bridge (this has no anatomical nomenclature since it is not a classical landmark. It is marked X on Fig. 3.13. It is the point where the horizontal projection of pi cuts the nasal bridge).

Figure 3.13 Horizontal measurements from Profile View



3.6(ii) - Vertical Measurements from Profile View

16. Nasal Height (n -sn) vertical distance from nasion to base of nasal septum, i.e. subnasale (Fig. 3.14).

17. Height of Whole Upper Lip (sn - sto) vertical medial distance between subnasale and stomion. This is whole of upper lip including the cutaneous upper lip as measured in measurement 7 (Fig. 3.14)

18. Vertical Height of the Lower Face (sn - gn) vertical distance between the subnasale and the gnathion (Fig. 3.14)

19. Height of Forehead above Eyebrows (tr - sci) vertical distance between trichian and superciliare (Fig. 3.14).

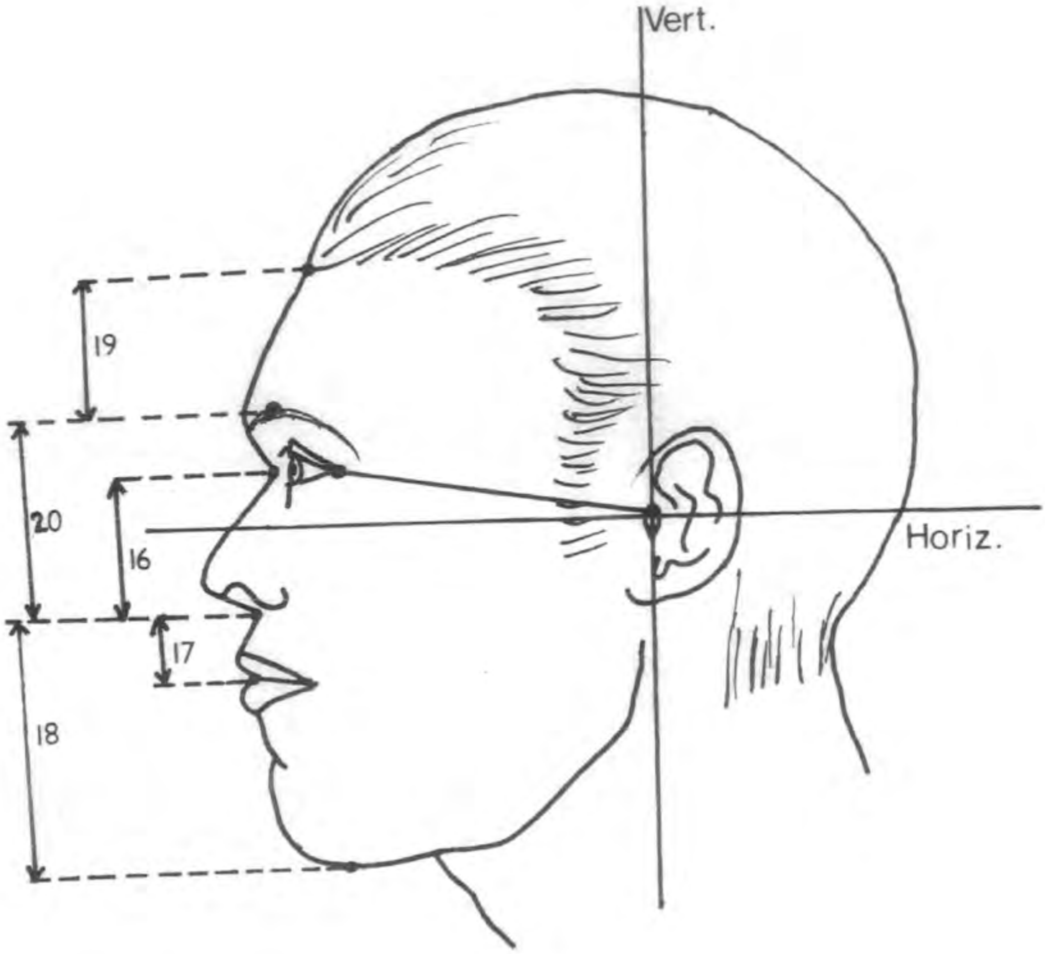


Figure 3.14 Vertical Measurements - Lateral View

20. Height of Upper Face (sci - sn) vertical distance from superciliare to subnasale (Fig. 3.14).

3.6(iii) - Lateral Measurements from Profile View

21. Orbit - Auricle Distance (ex - po) distance from the exocanthion to porion. This gives depth of upper face (Fig. 3.15)

22. Auricle - Chin Distance (po - pg) distance from top of external auditory meatus (porion) to anterior point of chin (pogonion), (Fig. 3.15).

23. Height of Face (n - gn) the distance between nasion and gnathion. Brothwell and Harvey (1965) call this Lower Facial Height but this is different from Vertical Height of Lower Face (measurement no. 18), Farkas (1981) calls this measurement Morphological Height of Face (he measures vertically however), (Fig. 3.15).

24. Columella Length (c - sn) distance between the highest point on the columella crest of nose and the subnasale (Fig.3.15)

3.6(iv) - Angles Measured from Profile View

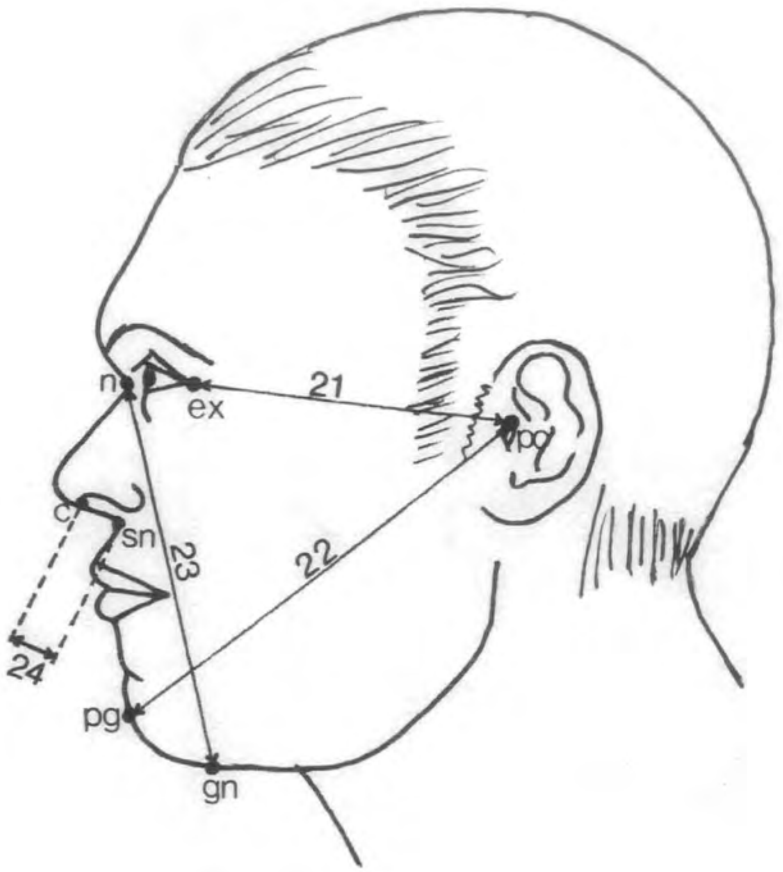
25. Nasal Angle - Angle subtended by line connecting most anterior point of nasal tip (pronasale) and nasion, and the horizontal. (Fig. 3.16).

26. Nasal Base Angle - Angle subtended line connecting nasion and subnasale and the vertical (Fig. 3.17).

27. Upper Lip Angle - Angle subtended by line connecting subnasale with upper margin of upper lip and the vertical (scored + or - for anterior or posterior of vertical), (Fig. 3.18).

28. Chin Angle - Angle subtended by line between subnasale and pogonion and vertical (scored + or - for anterior or posterior of vertical), (Fig. 3.19).

Figure 3.15 Lateral Measurements from Profile View



29. Frontal Recession Angle - Lines at 11 degrees and 25 degrees to line joining ex and po are drawn from the porion to intersect the frontal region. The frontal recession angle is that angle subtended by a line between the two points of frontal intersection and the horizontal (Fig. 3.20).

Figure 3.16 Nasal Angle

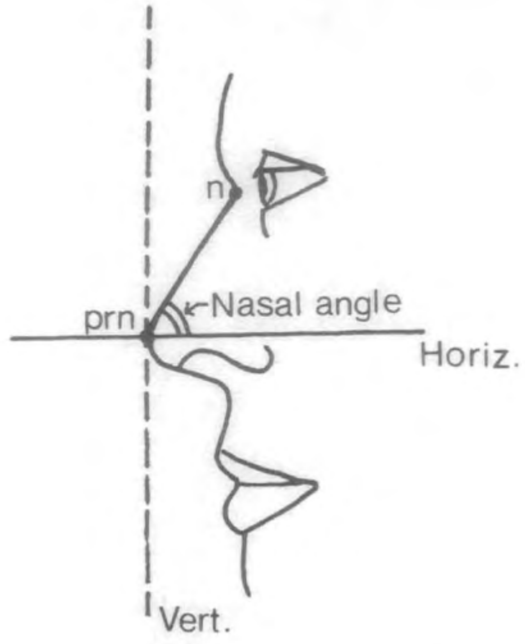
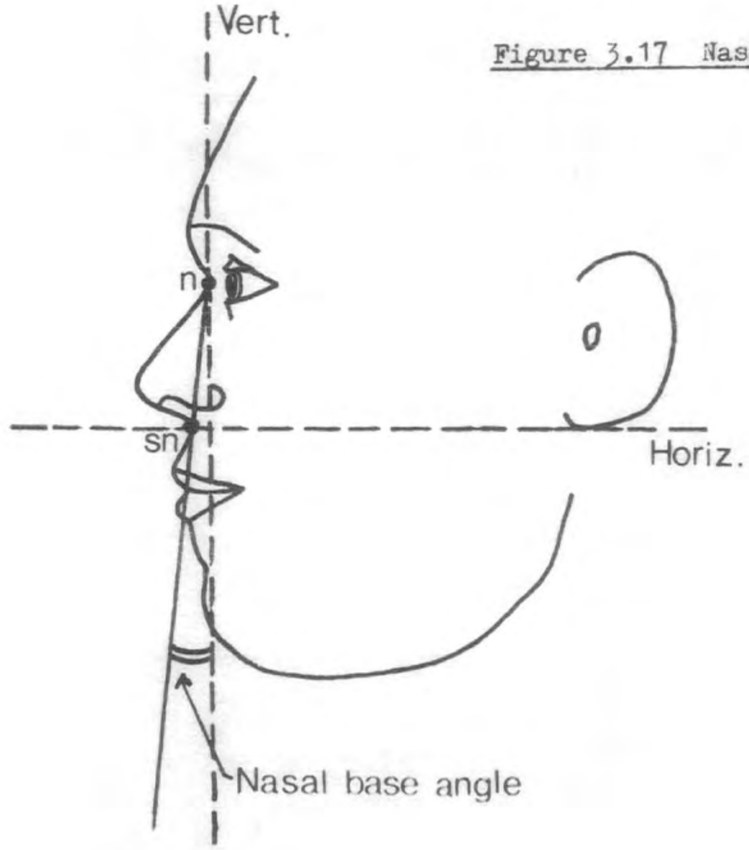


Figure 3.17 Nasal Base Angle



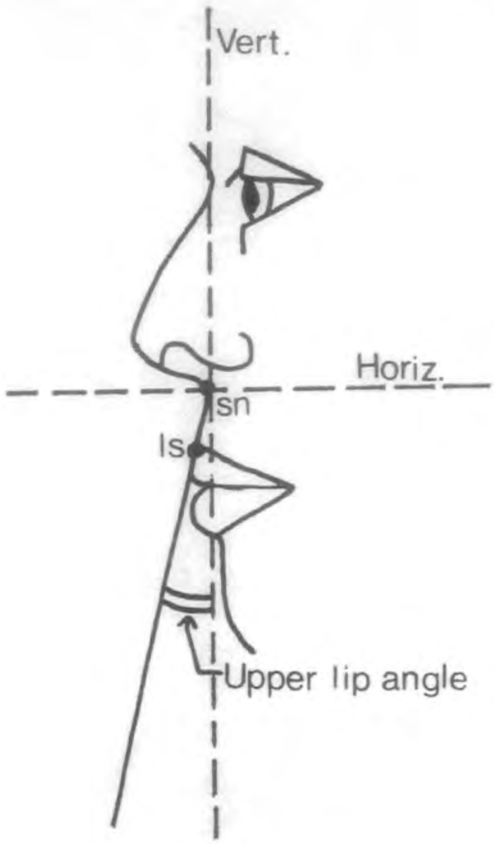


Figure 3.18 Upper Lip Angle

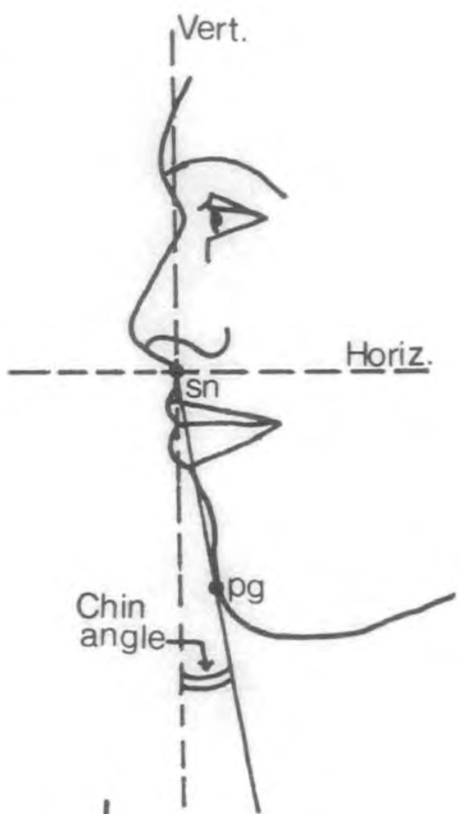


Figure 3.19 Chin Angle

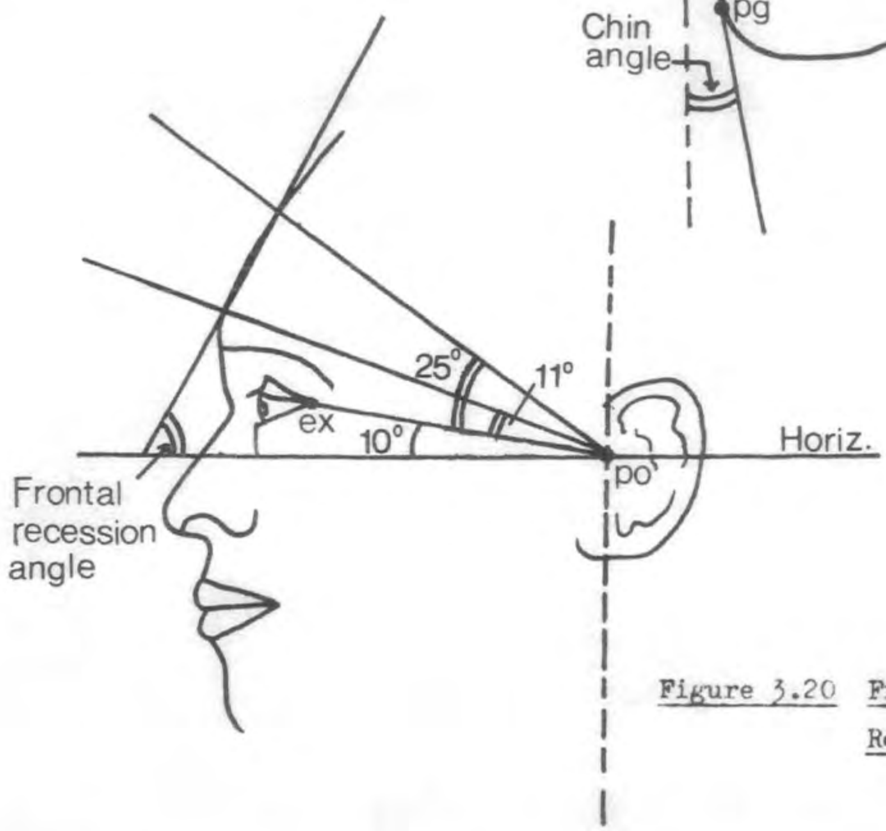
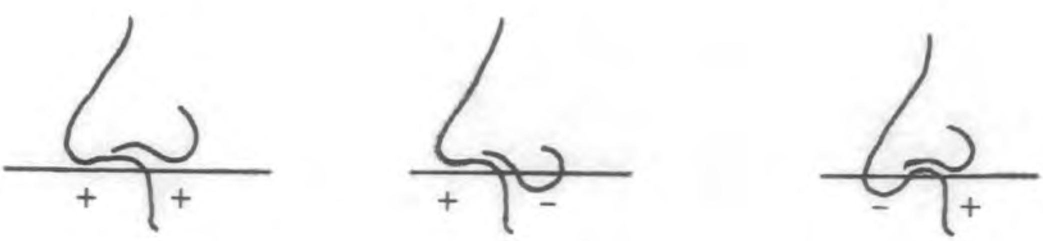


Figure 3.20 Frontal Recession Angle

3.6(v) - Relationships from Profile View

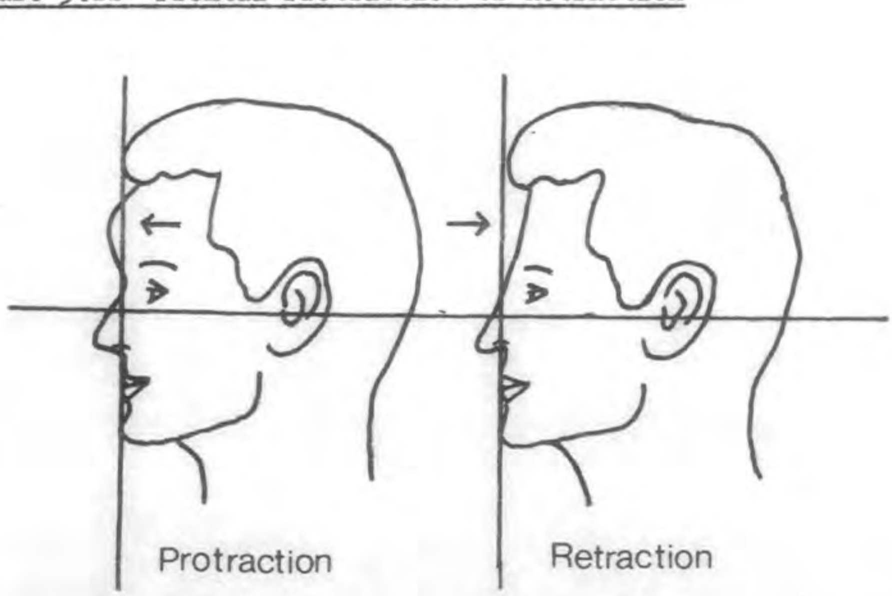
30. Nasal Wing/Septum Relationship- a line is drawn in the horizontal plane cutting through the subnasale. The positions of the nasal wing and septum in relation to this line are then scored + for above, - for below and o where nasal contour runs along horizontal (Fig. 3.21)

Figure 3.21 Nasal Wing/Septum Relationship varieties



31. Frontal Protraction or Retraction - a vertical line is constructed at right angles to the horizontal orientation line passing through the nasion. The position of the frontal region of the head is the scored + for protraction, - for retraction or o for frontal region running along vertical (Fig. 3.22)

Figure 3.22 Frontal Protraction or Retraction



32. Nasal Protraction or Retraction - relationship of the nasal region relative to a vertical line passing through nasion (+ for protraction, - for retraction, o for nasal region running along vertical), (see Fig. 3.23).

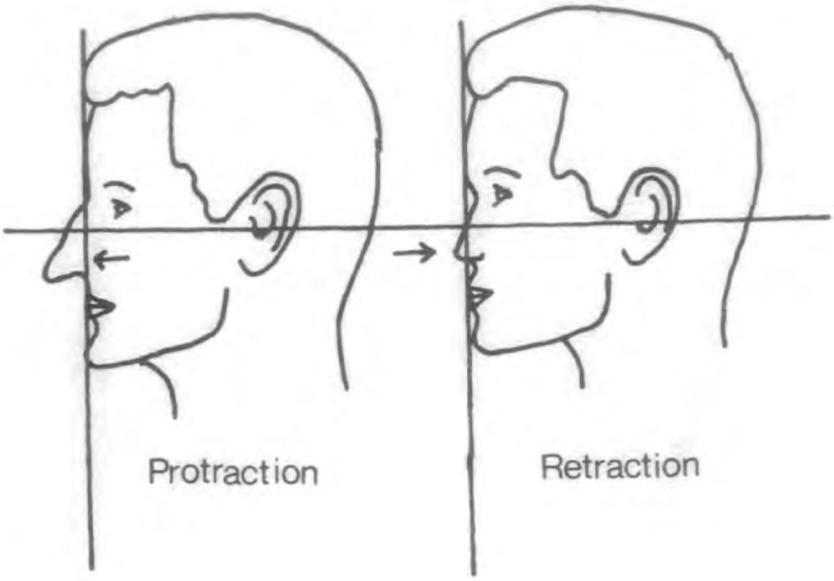
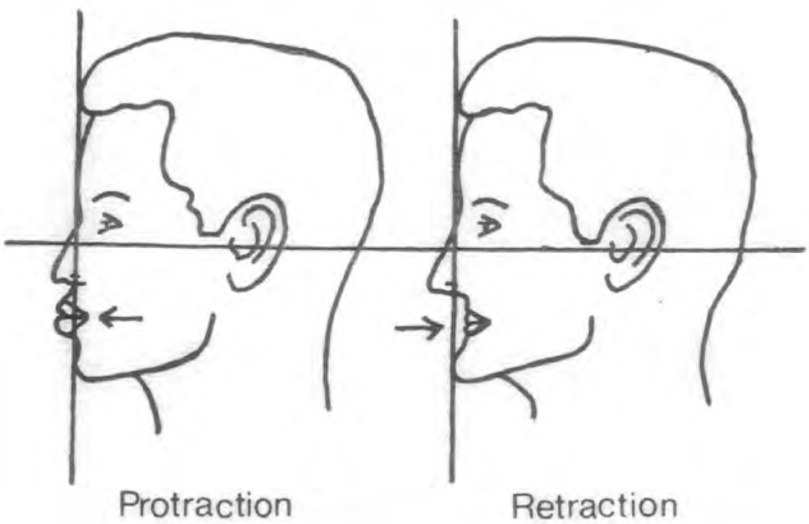


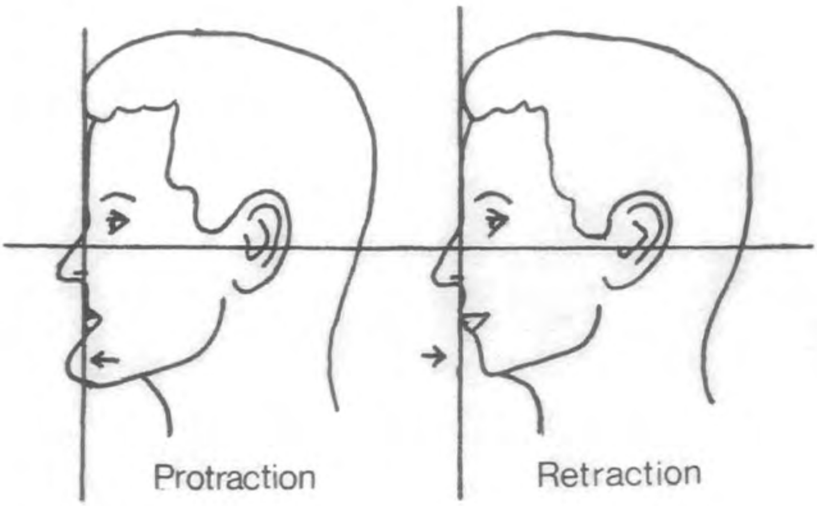
Figure 3.23 Nasal protraction or retraction

33. Labial Protraction and Retraction - relationship of labial region relative to vertical line passing through nasion as for 31 and 32 above .

Figure 3.24 Protraction or retraction of labial region



34. Mandibular Protraction or Retraction - relationship of mandibular region to vertical line passing through nasion (as for 31, 32 and 33). See Fig. 3.25.



<u>Figure 3.25 Protraction or retraction of mandibular region</u>

Table 3.2 - Measurements Taken

VIEW	PLANE	NO	MEASUREMENT	LANDMARKS
Frontal	Horizontal	1	Bizygomatic Diameter	zy - zy
		2	Biaural Breadth	ea - ea
		3	Nasal Breadth	al - al
		4	Inter-Occular Dist.	en - en
		5	Bioccular Diameter	ex - ex
		6	Mouth Width	ch - ch
	Vertical	7	Upper lip height	ls - sto
		8	Lower lip height	sto - li
		9	Total lip height	ls - li
	Other	10	R.Eye Fissure ht.	ps - pi
		11	L.Eye Fissure ht.	ps - pi
		12	R.Eye Fissure width	en - ex
		13	L.Eye Fissure width	en - ex
Profile	Horizontal	14	Nasal Prominence	prn - ap
		15	Nasal Bridge Dist.	pi - x
	Vertical	16	Nasal Height	n - sn
		17	Ht.- Whole Upper Lip	sn - sto
		18	Vert.Ht.- Lower face	sn - gn
		19	Ht. of Forehead	tr - sci
		20	Ht. of Upper face	sci - sn
	Lateral	21	Orbit-Auricle Dist.	ex - po
		22	Auricle-chin Dist.	po - pg
		23	Height of face	n - gn
		24	Columella length	c - sn
	Angles	25	Nasal Angle	Ang.prn-n and horiz.
		26	Nasal Base Angle	Ang.n-sn and vert.
		27	Upper Lip Angle	Ang. sn-ls and vert
		28	Chin Angle	Ang.sn-pg and vert.
		29	Frontal Rec. Angle	Ang.Front Region and horiz.
	Relationships	30	Nasal Wing/Septum Rel	Rel.of Wing/Septum to horiz.
		31	Frontal Prot or Retr	Rel.of Frontal region to vert.
		32	Nasal Prot. or Retr.	Rel.of Nasal region to vert.
		33	Labial Prot.or Retr.	Rel.of Labial region to vert.
		34	Mandibular Prot. or Retr.	Rel.of Mandibular region to vert.

3.7 - Measurement and Recording of Results

The drawings made from the projection of the transparencies in the case of the Tanzanian subjects or the photographs in the British series were each measured in the same way. The drawing or print was attached to a drawing board and then the heads were orientated as explained in sections 3.5 and 3.6. This was done using a ruler, set squares, protractor and t-square. The landmarks were then identified and marked on the drawing or print with a fine pointed pen. Horizontal and vertical projections were then drawn through these points as appropriate. The distance between the landmarks, as specified in the last two sections, were then measured using a pair of dividers and a clear plastic ruler. Angles were measured using a clear plastic protractor. In either case measurement was made to the nearest millimetre or degree, fractions of degrees or millimetres were rounded up to the next highest degree or millimetre.

The resulting measurements were then recorded on an individual card for each subject along with the reference number, genealogical and geographical details and the measured height of the scales held in position on the frontal and vertical views (see Table 3.3). The measurements were then scaled up to absolute values using a pocket electronic calculator and entered on the computer data sheet (Table 3.4) which was then entered onto the Durham University computer by the Data Preparation staff. The codes used on this sheet are shown in Appendix 1.

Table 3.3 Subject's data sheet

Reference Number: ______________________

Place of Photography: ___________________

Age of Subject: _________________________

Subject's birthplace: ___________________

Subjects Father's birthplace: ___________

Subjects Mother's birthplace: ___________

Frontal Scale = ________ mm.

Measurements Frontal View

1 = ________ mm.
2 = ________ mm.
3 = ________ mm.
4 = ________ mm.
5 = ________ mm.
6 = ________ mm.
7 = ________ mm.
8 = ________ mm.
9 = ________ mm.
10 = ________ mm.
11 = ________ mm.
12 = ________ mm.
13 = ________ mm.

Lateral Scale = ________ mm.

Measurements Lateral View

14 = ________ mm.
15 = ________ mm.
16 = ________ mm.
17 = ________ mm.
18 = ________ mm.
19 = ________ mm.
20 = ________ mm.
21 = ________ mm.
22 = ________ mm.
23 = ________
24 = ________
25 = ________
26 = ________
27 = ________
28 = ________
29 = ________
30 = ____/____
31 = ____/____
32 = ____/____
33 = ____/____
34 = ____/____

Table 3.4 Computer Data Entry Sheet

CASE NO.				CARD	SUBJECT LOC.			FATHER LOC.			MOTHER LOC.			SEX	AGE		ST.	V1	
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20

V2			V3			V4		V5			V6		V7		V8		V9		
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

V10		V11		V12		V13		V14		V15			V16			V17		V18	
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

V19		V20		V21		V22		V23			V24	V25			V26			V27	
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CASE NO.				CARD	V28			V29			V30			V31			V32		
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20

V33		V34			V35		V36	V37	V38	V39	V40			V41			V42		
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

V43			V44			V45			V46										
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

CHAPTER FOUR - SOURCES OF ERROR

4.1 - Introduction

Whilst every precaution was taken to minimize error, it is inevitable that various sources of error remained and could not be completely eradicated since they constitute an integral part of the methodology employed. In this chapter, therefore, I will attempt to identify and enumerate those sources of error so that the results obtained may be viewed in relation to the magnitude of error produced.

Errors occur due to the methodology employed which, in this investigation, may be due to photographic technique, the method of production of the prints or drawings, interpretation of the photographs, location of landmarks on the photographs, measurement technique or treatment of the data collected. I will discuss each of these potential sources of error in turn.

Finally, I will discuss how some of the errors could have been reduced further. This is a retrospective examination of technique and, as stated before, as many precautions as possible were employed with the aim of minimizing error. These are mentioned where appropriate in this chapter and, indeed, many have already been described in Chapter Three - Methodology.

4.2 - Error due to Photographic Technique

4.2(i) - Lens Focal Length and Subject - Camera Distance

These two factors are interconnected in the production of visual distortion. Severe visual distortion of facial features can occur when lenses of different focal length are used at varying distances. The distortion is produced because a variation of visual perspective occurs. Perspective is the representation of a three-dimensional subject on a plane surface (I shall deal with this further below).

A standard 50 mm. lens causes distortion at the usual portrait distance of approximately 200 mm. We normally view the face at a distance of 300 - 400 mm. and, therefore, the face appears to be unnatural due to the unusually close subject - camera distance.

Morello et al. (1977) recommend a camera lens of focal length twice the length of the film diagonal. Thus, a 100 or 105 mm. lens is required for a 35 mm. camera. Farkas (1981) recommends a lens-subject distance of over 3 metres (3352.8 mm.). He calculated that by using this distance photographic error is reduced to less than 1 degree. It is interesting to note that the distance recommended by Farkas is 2.2 times greater than the minimum recommended by Gavan et al. (1952). Farkas based his distance on the maximum head breadth of the subject being photographed, which he found in adult men to be 153 mm. The large lens - subject distance minimizes distortion in the plane on which the camera is focused. It does not, however, reduce distortions in other planes, as described below.

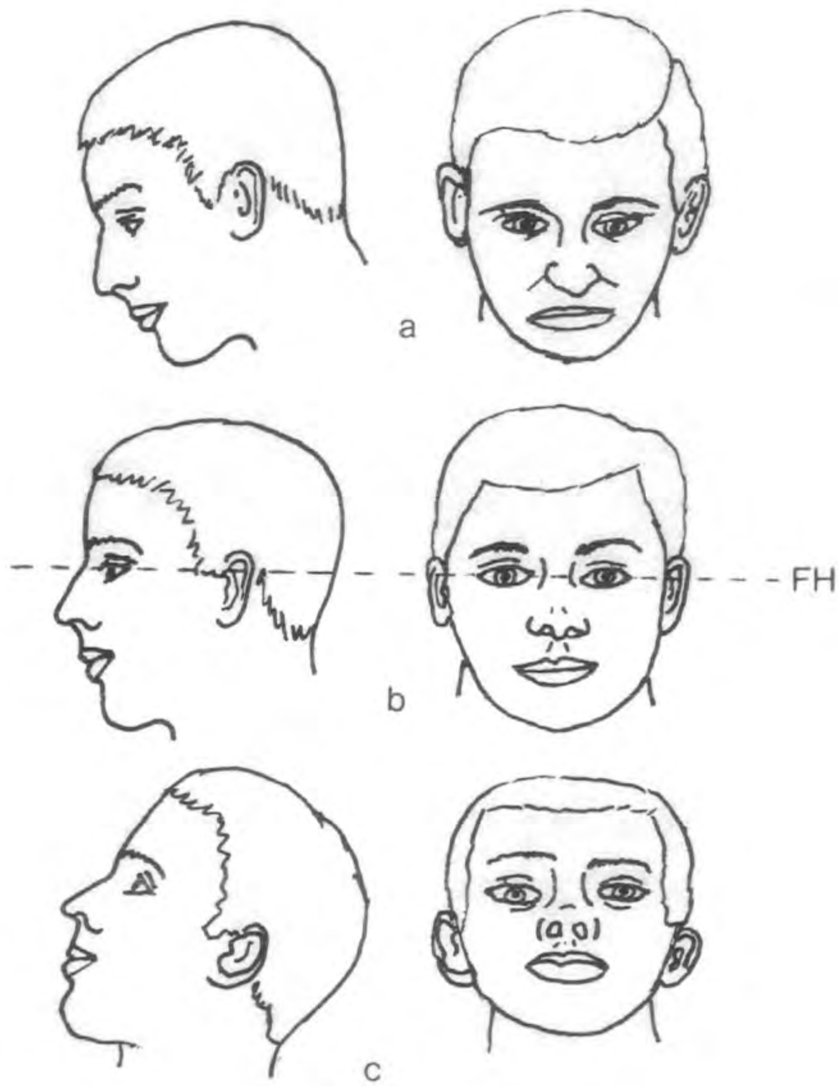
The subject - lens distance and camera focal - length were adopted as described above to minimize error - a lens subject distance of $3\frac{1}{2}$ metres and a 35 mm. camera with 135 mm. lens was used.

4.2(ii) - Camera Position and Subjects Head Position

These two factors are interlinked and cause error due to the subject's head not being in the required standardized positions of Frankfort vertical or horizontal depending on the particular view.

If the subject is photographed from above, the nose appears on the photograph to be greatly lengthened. If the subject is photographed from below, the nose this time appears to be greatly shortened. Therefore, when taking the front view photographs the camera must be positioned in the centre of the face. Figure 4.1 shows how the same effect is caused by altering the position of the head in relation to the camera. When the head is tilted upwards the nose appears to be shortened, or, when tilted downwards it appears to be lengthened. Dickason and Hanna (1976) show, in their paper, that a 'rhinoplasty', plastic surgery to reduce the length of the nose, can be brought about on film by simply tilting the head upwards.

Figure 4.1 The effect of altering the subjects head position in re-lation to the lens of the camera. The middle drawing (b) shows the correct head position (Frankfort Horizontal). In (a) the head is down facing and in (c) facing upwards.



A similar effect can be brought about in profile photo--graphs by varying the position of the face from the standardized Frankfort Vertical. Without tilting the head a variation of a few degrees of the facial plane towards or away from the camera produces an apparent decrease or increase in the size of the nose.

Not only is nasal length altered by varying the head or camera position but other facial features are likewise altered. In Figure 4.1 the eye fissure height and height of mouth are shortened by the head being tilted downwards or the photograph being taken from above the standardized position. The whole head length also appears longer in this case with consequent altering of the various proportions of the parts of the face (see Ehrhardt, 1956).

4.2(iii) - Position and Intensity of Lighting

Morello et al. (1977) describe lighting overall to be the greatest source of error in the photography of the face of subjects. Chapple and Stephenson (1970) state that light is necessary all around to be able to discern the three - dimensional proporties of the head and face on the photograph. If the light is raised to approximately 45 degrees above eye - level and moved gradually from side to side shadows are cast on one side making it extremely difficult to appreciate the details on that side. More than one light source is, therefore, required for lighting the face.

With front lighting the face is flattened and is lacking in detail and at the borders the hair fuses with the dark background produced.

The best solution, therefore, is to light the subject with one light from the right hand side which will illuminate the forehead and right side of the face but will cast the left side of the face in shadow. This is then removed by using a second light at the front, close to the camera lens, but at half - strength to act as a fill-

-light. The background must also be of a light colour and if possible lit to avoid fusion of the subject's hair with the background. The background also had to be placed some 3 feet behind the subject to eliminate shadows. This is the most common type of set-up using two lights one close to the lens at half the strength of a second light in a more upward and lateral position at approximately 45 degrees to the facial plane. This set-up has been used by Dickason and Hanna (1976), Morello et al. (1977), Tuerk et al. (1956), Edgerton et al. (1970), Farkas et al. (1980) and Chapple and Stephenson (1970), and was used in this study.

The use of cosmetics can also change the contours of the face in the same way as different types of lighting can do. For example if the sides of the nose are shadowed using comestics it appears narrower, the nose can appear to be bent by uneven application of cosmetics to the sides of the nose or can be straightened using front lighting and cosmetics on both sides of the nose (see Dickason and Hanna 1976). For this reason the subjects were photographed without cosmetics.

4.2(iv) - Plane of Focus

Since the surface of the face is extremely uneven a certain amount of distortion cannot be avoided. The camera can only be focused on one particular point or plane and hence the other points or planes are slightly out of focus. Figures 4.2 and 4.3 show the differences in level between various points of the face and those on the focusing planes used in this study i.e. scale at corner of eye for frontal view and at tip of nose for profile view (see Figs. 3.1 and 3.2). As can be seen from the diagrams there is a considerable difference in distance between the points in focus (i.e. on focusing plane) and those on other planes and hence out of focus.

Albrecht Dürer (1591) believed that the face could be

Figure 4.2 Diagram to show relative distances between the facial profile landmarks and the focusing plane

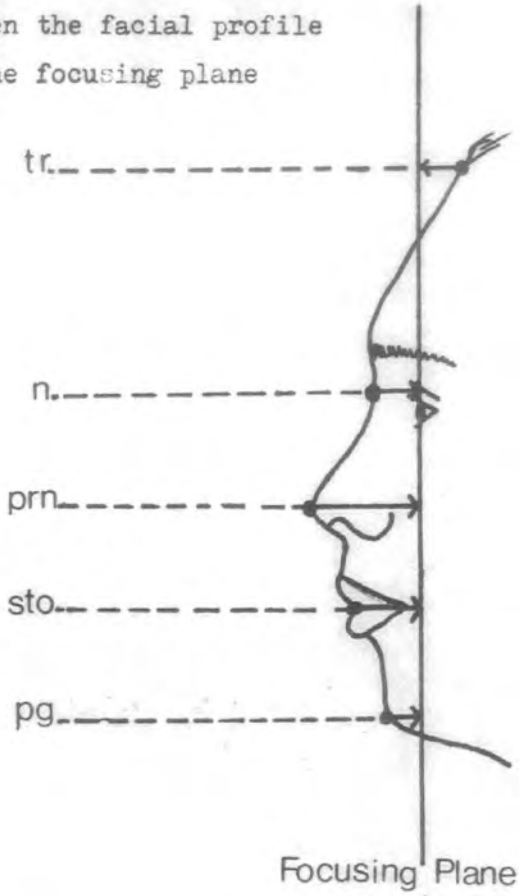
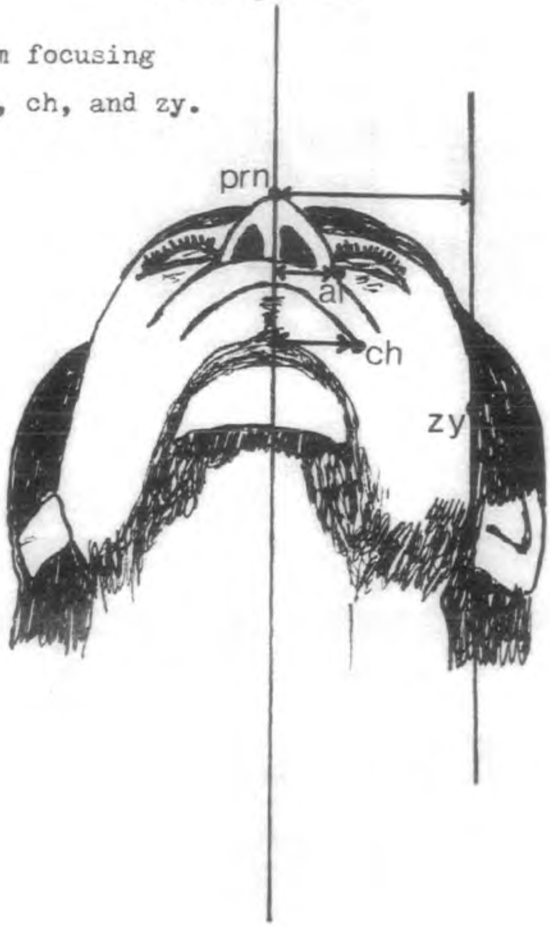
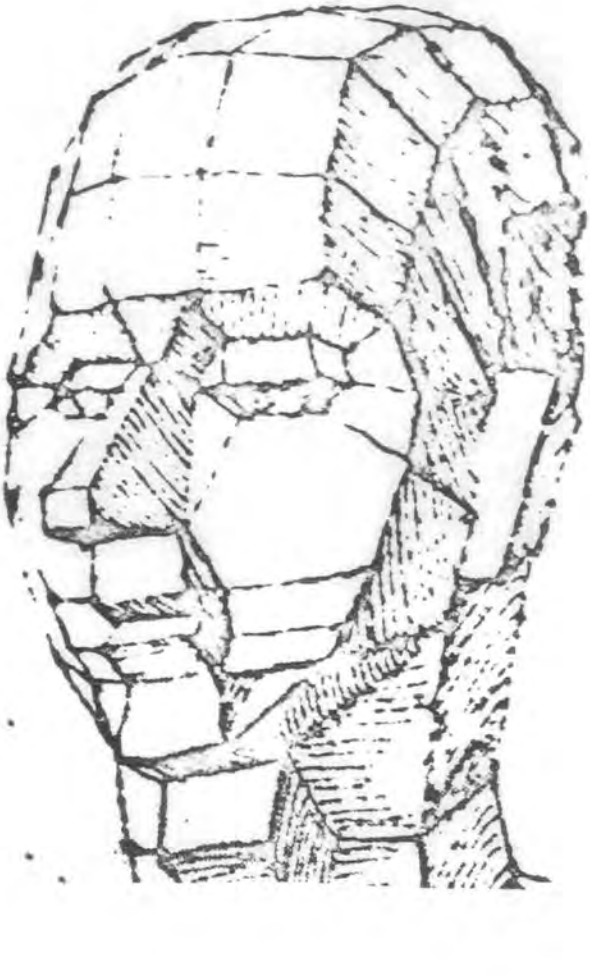


Figure 4.3 Distances from focusing plane (tip of nose) of al, ch, and zy. From profile view



regarded as "a multi-faceted formation" consisting of a number of "small geometric areas joined at various angles". The degree of distortion, when viewing a particular point on the face, depends on the differences in the level of the individual facets, one of which the point will be located on, and the position in which the focusing plane is relative to these facets. Dürer's concept of the surface relief of the face is shown in Figure 4.4.

Figure 4.4 Dürer's concept of the surface relief of the craniofacial complex



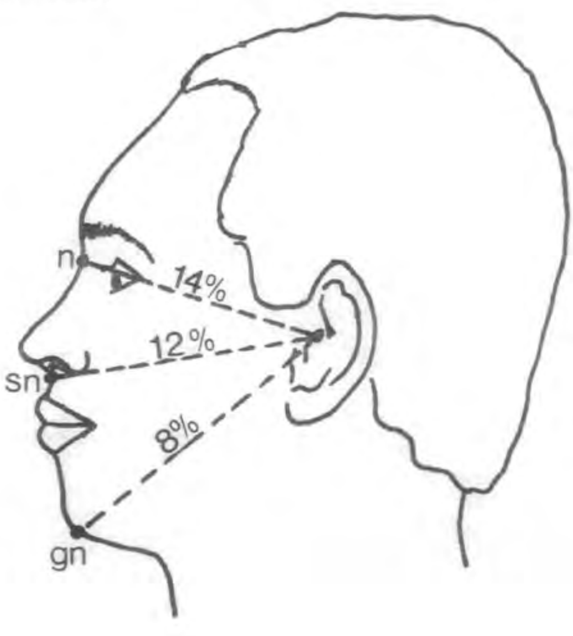
4.3 - Error Resulting from Interpretation of the Photographs

The main error in interpreting the photographs is that a three - dimensional object is presented in two - dimensional form. The head and face being the object and the photograph the two - dimen-

-sional image. An appreciation of the three - dimensional nature of the craniofacial complex must be borne in mind while carrying out the two - dimensional geometry used in measuring the photographs. Distances measured on the plane surface of a photograph between points at differ--ent distances from the camera cannot be treated as truly accurate measures of the same distances taken by anthropometric methods from the actual face. Failure to appreciate this fundamental difference in dimensional form leads to significant errors in results.

The greatest errors occur when sagittal measurements (e.g. sn - prn) are taken from frontal - view prints. Farkas et al.(1980) carried out a survey of photogrammetric measurements compared with the same anthropometric measurements taken from the same individuals. The two - dimensional nature of the print, they found, caused most error when measuring lateral distances of the face from the profile view. Figure 4.5 shows the shortening of lateral measurements expressed as percentages of the direct measurements. The greatest error resulted from measurement of the upper - third of the face.

Figure 4.5 Shortening of lateral measurements as percentages of direct measurements



The width of the ears taken from the profile view was im--possible to measure because it was inversely related to the protrusion of the auricles from the head. The greater the protrusion of the auricles, the narrower the ear. Measurements of the ears were, because of difficulties such as this, restricted to the biaural breadth measure--ment. Brothwell and Harvey (1965) carried out twenty measurements on a number of subjects using both frontal and profile views. They pub--lished results of four of these measurements taken from both views and compared them. The degree of difference between the recorded measurements taken from the front and lateral view vary by as much as 10 percent.

4.4 - Error due to the identification and location of landmarks on the photographs

The landmarks of the facial profile and the forehead (i.e. n, prn, sn, ls, sto, pg, gn and tr) are not always visible on the lateral photograph. In profile, flattening along the axial line (root of nose, tip of nose, chin etc.) and in some cases a slight axial de--pression (at the base of the columella, in the middle of the border of the upper vermilion line, on the chin etc.) make landmarks invisible on the lateral point. When visible, these landmarks, because of their location, are not always sharp enough on the print. This is also the case with landmarks located on the edges, or contours, of anatomical features. The loss of clarity of these landmarks on the print may result from the differing intensities of reflection of various areas of the face and lead to difficulty in identifying them on the photograph.

Sometimes landmarks are covered by hair or hidden behind facial features. From the lateral view and frontal view the trichion can be hidden by hair. Significant errors may be produced in the measurement of the length or width of the head due to the vertex, zygions and gnathion being hidden by hair (sideboards or beard). The points on the upper and lower lips may be obscured if the person has a moustache or beard as may be the subnasale.

The view of some landmarks may be totally or partially blocked by other features. The porion, for example, may be hidden by the tragus on the lateral print (see Figure 4.6). The commissure of the eye fissure may be obscured by a skinfold, a condition particularly noticeable in people suffering from marked epicanthus, thus causing the endocanthion (en) or exocanthion (ex) to be hidden from view (see Figure 4.7). The commissure of the labial fissure may be hidden by a

Figure 4.6 Diagram to show how porion may be hidden by tragus

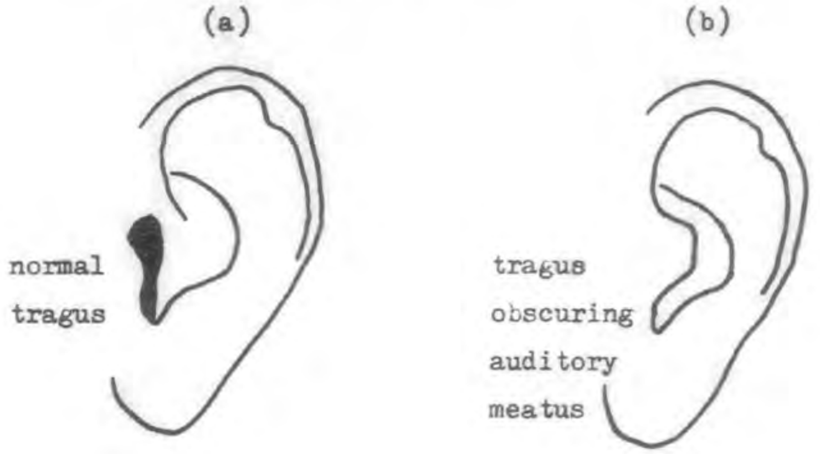
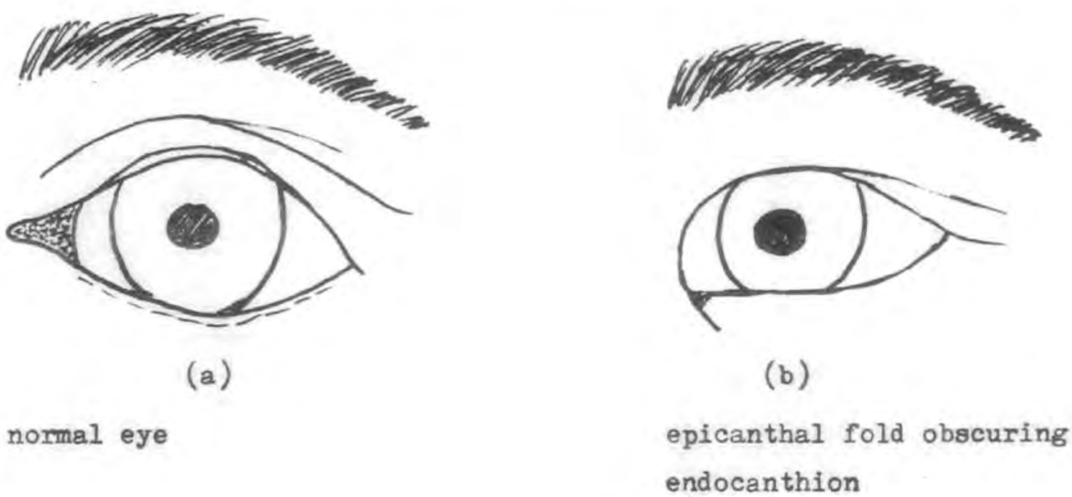


Figure 4.7 Diagram to show how skinfolds can obscure landmarks of eye



skinfold causing the cheilion (ch) to be obstructed from view. In the profile view the alar posterior point (ap) and the cheilion may be blocked from view in individuals possessing fleshy bulging cheeks (see Figure 4.8).

Figure 4.8(a) Normal view of cheilion and alar posterior point land--marks in profile view

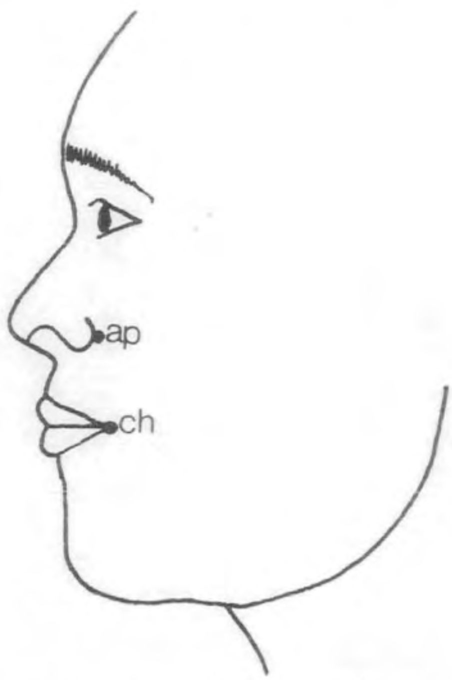


Figure 4.8(b) Landmarks hidden by cheek

Soft landmarks on the skin surface (e.g. labiale superius or inferius, cheilion, pronasale) or on the edge of soft facial features (e.g. alare, palpebrale inferius and superius) may be difficult to locate if there is any deformity of the subject's face, no matter how minimal this may be.

Sometimes the nasion is difficult to locate on the nose due to thick soft - tissue cover. This is only one instance of the diffi--culties of using soft landmarks on the skin surface to represent osseous landmarks on the bone underlying the soft tissue. This leads to only approximation of the exact location of the measuring point and hence to error. The problems involved in substituting soft landmarks for bony landmarks has been discussed more fully in Chapter Three, Section 3.4.

Inaccuracies in the measurement of angles may occur because the lateral print does not precisely reflect the true facial contour. If there is any flattening or depression in the midline of the face, the profile visible on the print will differ from the true profile. Thus, the accuracy of the inclinations and the angles on the print may be affected.

4.5 - Error due to the method of production of the prints or drawings

The Tanzanian series was provided for me in the form of black and white transparencies. These were projected onto a screen, on which a piece of white drawing paper was clipped, and then drawn (see Section 3.3). The actual drawing of the face from the projected transparency image could lead to error due to inaccuracy in tracing the contours and facial features correctly. If the screen and projector were not exactly at right angles to each other distortion of the image and hence the final drawing could occur. There could be lengthening or shortening of various portions of the face similar to that resulting from incorrect camera or head positioning when taking the photographs.

To overcome this potential source of error the angles of the projector and screen were periodically checked using a carpenter's spirit level.

The British sample was provided as prints taken from the original negatives. These prints were produced using a commercialy produced enlarger and made by a professional photographer. Errors could be caused if the projection unit and paper holder were not at right angles but since the enlargers were expensive technical instru-ments it would be expected that this type of error would be minimal in this case.

The main error in the method of production of the print or drawing to be measured was that two different methods were used as described above. The fact that one standardized procedure was not used for both samples is the main source of error which could have occured here.

4.6 - Error from measuring technique

On the prints and drawings, linear distances between land-marks were measured using a transparent perspex ruler. Inclinations and angles were determined using a transparent protractor, the degree of inclination was calculated from the horizontal or vertical as defined by the Frankfort Horizontal which was marked using protractor and set-squares. All the measuring was carried out with the prints or diagrams clipped on a technical drawing board and a set of good quality technical instruments was used. Fractions of millimetres or degrees were rounded up to the next highest cipher. Errors because of this are, therefore, approximately ± 1mm. or ± 1 degree. There may also be errors due to the accuracy of calibration of instruments, refractive index of the perspex and parallax errors. To minimize these, three readings were taken for each variable measured and the average was recorded in the table of results.

4.7 - Methods of Reducing Error

4.7(i) - Introduction

In the chapter on methodology (Chapter 3) and in the sections on errors (Sections 4.2 to 4.6), measures taken to minimize error have been discussed. In this section methods which, in retrospect, could have been used, or other techniques which are possible, for reducing error are discussed.

4.7(ii) - Reducing error due to improper identification of landmarks

A common anthropometric method (Weiner and Lourie 1969, 1971) which could have been used is to mark the landmarks before photography takes place. The bony landmarks are then more accurately identified since they can be located by palpation and then marked on the skin surface with a washable ink pen. To further assist in the identifica--tion of some landmarks, which are even now difficult to locate, Farkas et al. (1980) suggest that V-shaped markers can also be drawn next to the marked measuring points and this will help in identification, particularly on the profile prints (see Fig. 4.9).

4.7(iii) - Reducing error due to improper head positioning

Farkas et al. (1980) used a specially converted dentist's chair for seating the subject during the process of photography. The chair has a specially designed head frame fitted to its top so that it goes across the top of the subjects head. The outer corners of the eyes can then be orientated to the vertical and horizontal axes and thus be placed in the correct Frankfort plane.

Farkas and Deutsch (1982) have also designed and produced two new instruments for ensuring the correct orientation of the head during photogrammetry. They consist of two small plexiglass structures which contain a bulb with liquid acting as a spirit level. The first one is T - shaped and has a black midline which is used for orientation

(a)

__Figure 4.9__ V-shaped markers as used on (a) Frontal View (b) Profile View to facilitate location of landmarks.

(b)

purposes. The top of the black line is aligned with the trichion and the bottom with the glabella. When the spirit level bubble is central the orientation is correct (see Fig. 4.10a). This is used for orientat--ing the face in the Frankfort plane for the frontal view. The second instrument is aligned with the exocanthion of the eye and tragion of the ear along the midline and when the bubble is central in the spirit level the correct plane has been achieved (Fig. 4.10b). Both instru--ments are attached by tape to the head before photography takes place.

Figure 4.10(a) Instrument for determining correct Frankfort horizontal for frontal view photograph

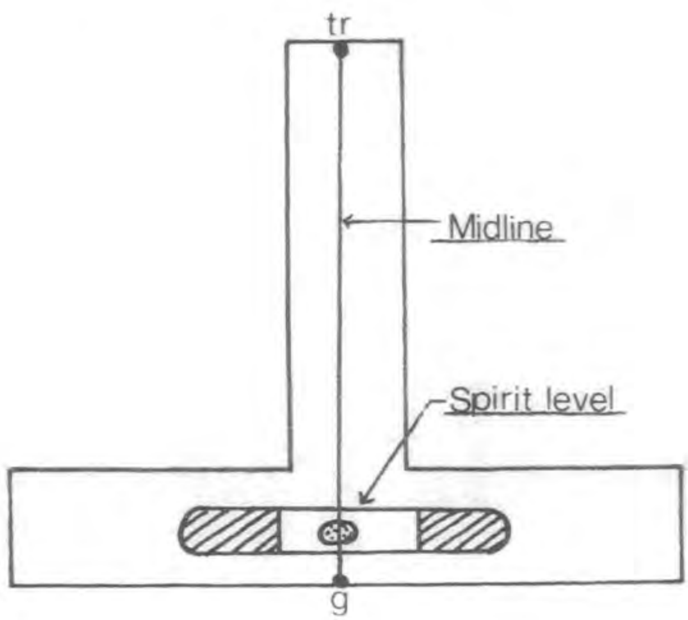
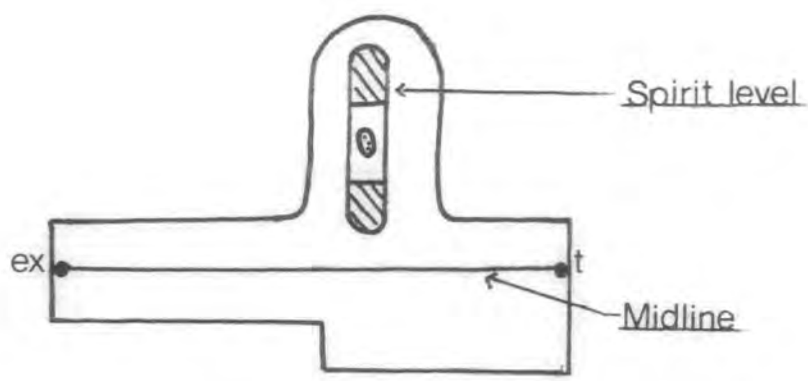
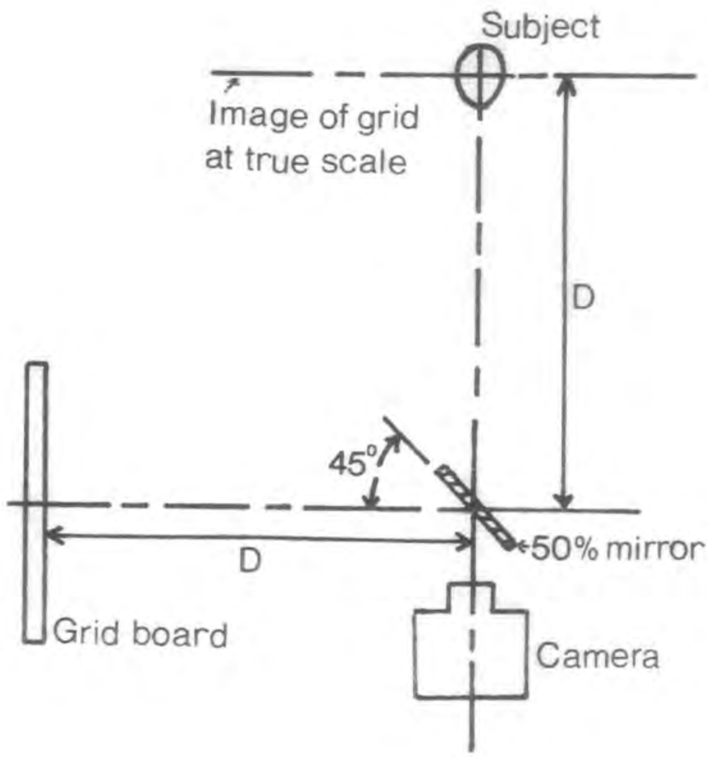


Figure 4.10(b) Instrument for determining vertical plane for lateral view



Other methods which have been employed to ensure correct head orientation are; placing needles in ears to get proper horizontal orientation (Broadbent and Matthews, 1957; Kraus et al.,1959) as used in cephalometry; Wheeler and Pertschuk (1982) and Roebuck et al. (1975) used a grid projected onto the facial plane from a projector (see Fig. 4.11); Morello et al. (1977) advocate the use of visual indicators positioned on the wall in front of the subject to orient the face; other methods include the use of stereotaxic apparatus and chin rests as used by opticians.

Figure 4.11 Partial Mirror Method (After Roebuck et al. 1975)

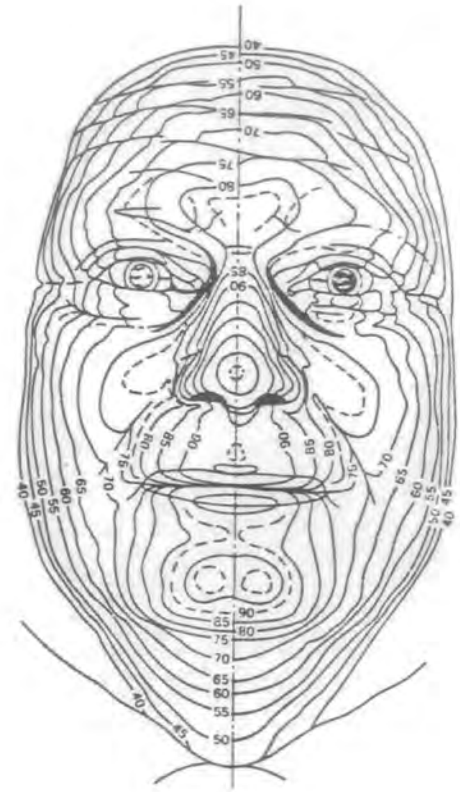


4.7(iv) - Reducing Errors due to the two - dimensional nature of the print

There have been various methods developed to produce a print which contains the third dimension. There are broadly speaking five systems of recording faces in three dimensions. These are; stereophotogrammetry, moiré topography, telecentric photography and physioprint.

Stereophotogrammetry of the face involves using two stereo camera and a special plotting machine. Zeller (1939 and 1952) used this method to obtain contour maps of the human face with 10 mm. separation between lines. Thalman-Degan (1944) improved upon Zeller's technique to produce prints with contour lines of 5 mm. separation. Thalman-Degan used his system for orthodontic diagnosis. Lacmann (1950) and Björn, Lundquist and Hjelmström (1954) used the same set up but combined the cameras with an automatic planimeter attached. They used their system for the measurement of facial contours of post-operative facial swellings. Savara in 1965 used a custom built stereo - camera and produced plots which were accurate to within 0.2 mm. Burke and Beard (1967) developed a simplified method which was less expensive for 3-D examination of facial morphology. They used two projectors adapted from an aerial survey plotting instrument. These projectors project a series of overlapping transparencies of aerial photographs. Burke and Beard used a point source of light that appears to float on the surface. The correct height is registered on a vernier gauge when the "floating spot" just rest on the surface of the face. In this way an experienced operator can build up a map of the face consisting of a number of con--tour lines related to the datum plane. Roebuck (1975) has tested Burke and Beard's method and found it to be accurate to less than 1 mm. A facial plot with contour intervals of 5 mm. is shown in Figure 4.12.

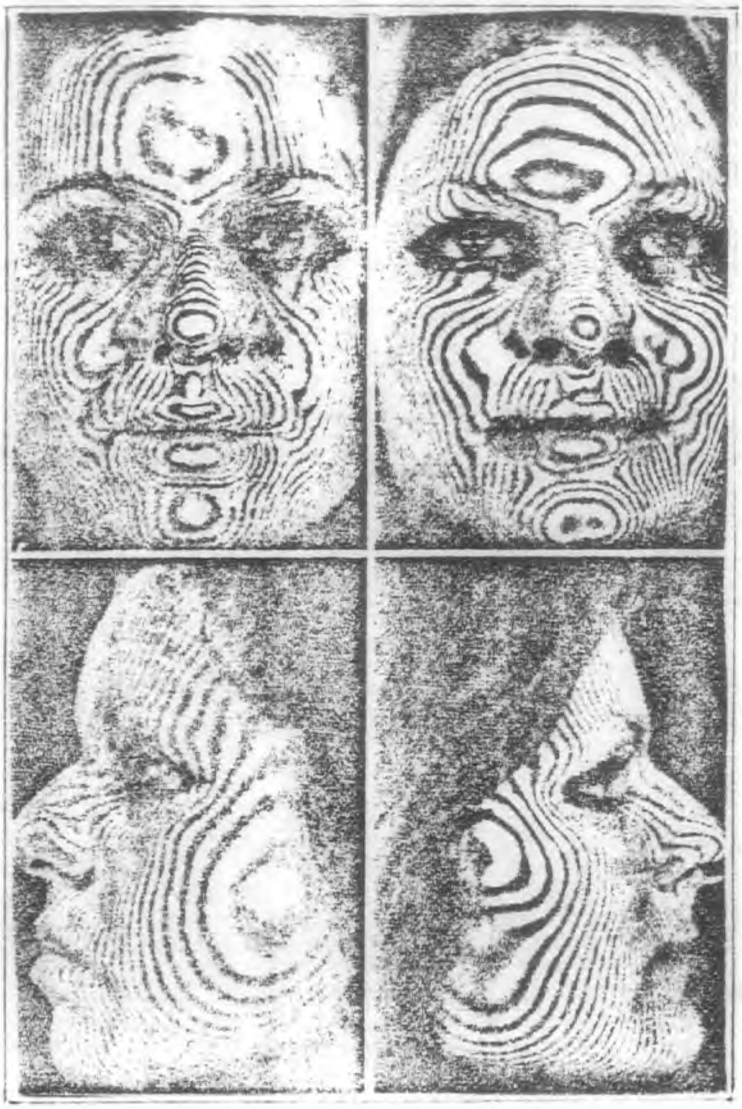
Figure 4.12 Contour map of face obtained using Burke and Beard technique



Moiré topography can be used to provide contour line maps. Standard moire technique uses a grid with rhonci ruling placed in front of the object to be contour mapped. The axis of illumination and the axis of photography are at any angle to each other causing interference fringes to be created each of which represents a series of points equidistant from the grid. When photographed these fringes appear superimposed on the face as contour lines. The distance of any fringe can be worked out from the grid. The calculations are made simpler using a computer and a scanning densitometer for reading the photographs. Figure 4.13 shows a series of faces with contour lines produced by moire fringes. This technique has been developed by Karlen et al. (1978)

in the U.S.A. and by Takasaki (1973, 1975), Asai (1978), Hojo et al. (1982), Murai et al. (1982) and Ohta et al. (1982) in Japan.

Figure 4.13 Contour lines produced using moire technique



Lovesey (1966) and (1974), Cobb (1971) discovered that by projecting slides consisting of 0.004 inch wide vertical black strips onto the side of the subject's face and photographing then at 90 degrees from the projection axis produced a contour pattern. The contour lines joined the locus of points of equal depth. There is an error of 2.5 percent because projected light rays are not quite parallel. This method is known as Telecentric photography.

The fourth method developed by Sassouni (1970) called physio-print involves using various approaches, facial contour analysis plus X - rays to measure the layer of skin covering the facial skeleton underneath and also the orthodontic analysis of the individual.

4.7(v) - Reliability of the Photogrammetric Method

Farkas et al. (1980) carried out an investigation into the reliability of the photogrammetric method by recording results obtained by photogrammetry of the face and those obtained by direct anthropometry.

Farkas et al. found that only 62 measurements could be obtained from the two prints or 40.4 percent fewer than were obtained by direct measurement. The greatest reduction was in the head (53 percent) and the least was in the lips (7 percent). Of the 62 indirect measurements 20 (32.3 percent) were reliable and 7 of these were from the area of the lips and mouth. No accurate measurements of the ears were registered. The largest number (9) of reliable measurements was of inclinations. Table 4.1 shows the reliable measurements in each area of the face and head.

Of 62 measurements, 41 were unreliable. Three were consistently longer and 22 were consistently shorter than the indirect measurements; the remaining 16 were mixed, since they were longer in some individuals and shorter in others.

There were three measurements that were consistently longer: the width of the face (zy - zy) by an average of 3.6 mm.; the width of the nose (al - al) by 2.4 mm.; and the width of the lower face (go - go) by 21.6 mm. All of these measurements were horizontal and were obtained from the frontal view prints.

There were 11 consistently shorter measurements taken from each print (see Table 4.2); more were horizontal (15) than vertical (7). The greatest shortening (17.6 mm.) was in the distance between the nasion

(n) and the tragion (t) on the profile print. On the frontal print, the greatest difference (5.5 mm.) was in the halves of the labial fissure (ch - sto).

Table 4.1 Reliable measurements obtained by photogrammetry

REGION	FRONT VIEW	PROFILE VIEW
HEAD		
		Frontal recession angle*
MID-FACE	n - sto dist.	
		nasal base angle*
		chin angle*
ORBITS	en - ex (right and left*	
	n - sn dist.	nasal angle*
	direction of labial fissure	columella length*
	en - en*	
LIPS & MOUTH		
	sbal - ls dist.	upper lip angle*
	ch - ch*	sn - sto dist.*
	ls - sto*	sto - li dist.
	sto - li*	
	ls - li*	
	cph - cph	

* indicates measurement used in this study

Table 4.2 Indirect measurement consistently shorter than the corresponding direct measurements

PRINT AND TYPE OF MEASUREMENT	MEASUREMENT	AVERAGE DIFFERENCE
Left lateral (n = 11)		
Horizontal	lt t - n	17.6
	lt. t - sn	15.3
	lt. t - gn	11.6
	lt. go - gn	13.2
	lt. ac - prn	3.5
	ch - t	5.6
	lt. obs - gn	14.6
	lt. obi - gn	9.6
Vertical	tr - n	2.0
	sn - gn	4.0
	sto - gn	3.9
Frontal (n = 11)		
Horizontal	ex - ex	2.0
	rt ex - en	2.3
	lt ex - en	2.4
	rt. sbal - sn	1.7
	lt. sbal - sn	2.5
	rt. ch - sto	5.5
	lt. ch - sto	5.1
	tr - g	3.5
	rt. or - sci	1.9
	rt. en - m	7.2
	lt en - m	7.4

There were 16 measurements with mixed differences depending on the individual facial characteristics of the subjects. Of these measurements, 12 (mostly vertical) were taken from the profile points 4 (3 horizontal) were taken from frontal prints (see Table 4.3). The greatest differences in measurements were in angles (± 5 degrees). The linear measurements differed little from the equivalent direct measurements. In general, vertical measurements showed smaller differences than did horizontal measurements.

Table 4.3 Measurements with mixed differences

PRINT & TYPE OF MEASUREMENT	MEASUREMENT	AVERAGE DIFFERENCES			
		LONGER		SHORTER	
		mm	degrees	mm	degrees
Left lateral (n = 12)					
Horizontal	pra - pra	1.3		2.5	
Vertical	tr - gn	2.5		4.3	
	n - gn	2.8		2.8	
	sn - sto	1.2		1.6	
	sa - sba	1.6		1.5	
	obs - obi	1.5		2.6	
	prn - sn	1.5		1.4	
	n - prn	1.1		1.4	
	ls - sto	1.3		1.3	
Angle	Nasolabial		4.5		6.0
	Nasofrontal		5.8		4.5
Inclination	Ear axis		2.9		4.7
Frontal (n = 4)					
Horizontal	ft - ft	4.0			
	t -t	3.4			
	ch - ch	2.8			
	rt ps - pi	1.2			

Three other reports on the reliability of photogrammetry have been carried out by Tanner and Weiner (1949), Gaven et al. (1952) and Fraser and Pashayan (1970). They mention only 16 of Farkas' measure--ments of the head and face. A few of these 16 measurements show the same trend as do those in Farkas's study (see table 4.4). Some discrepancies between data from the other literature and Farkas's re--sults may be caused by differences in marking technique and head positioning (Tanner and Weiner, Fraser and Pashayan). The sample of

Gavan et al. (2 subjects) was too small for valid conclusions to be drawn from it, but it is the only study that expresses differences quantitatively.

Table 4.4 Comparison of Photogrammetric Data from four studies

AREA	MEASUREMENT	TANNER and WEINER 1949 (n = 70)	GAVEN et al. 1952 (n = 2)	FRASER and PASHAYAN 1970(n = 50)	FARKAS et al. 1981(n =36)
Head	v - po		longer by 2 mm.		
	g - op		longer by 5 mm.		
	eu - eu		longer by 18 mm.		
	ft - ft	longer	longer by 12 mm.		longer by 4 mm. or short by 5.9 mm.
Face	zy - zy	same	longer by 18 mm.	"Correlated" well	longer by 3.6 mm.
	go - go	same			longer by 21.6 mm.
	n - gn				longer or shorter by 2.8mm.
	gn - go				shorter by 13.2mm.
Orbits	en - ex			"Correlated" well	same ±1mm.
	en - ex				shorter by 2 mm.
Nose	n - sn	longer	longer by 4 mm.	"Correlated" well	same ±1mm.
	al - al	longer			longer by 2.4 mm.
	n - prn				longer by 1.1 mm.
	sn - prn				longer by 1.5 mm.or shorter by 1.4 mm.
Mouth	ch - ch	Approx. same			longer by 2.8 mm.
	cph - cph				same ±1mm.

CHAPTER FIVE - ANALYSIS OF DATA

5.1 - Introduction

The measurements made from the photographs were recorded on the computer data sheet (Table 3.4) for each individual along with that person's genealogical information which was taken from the questionnaire (Table 3.3) and entered in coded form. The data from all of the subjects was then entered into the Durham University computer. When this had been carried out it was then possible to carry out various procedures to analyse the data collected. These procedures are described in this chapter - all used the "Statistical Package for the Social Sciences" (SPSS) system of computer programs, (Nie, N.H. et al. 1975).

5.2 - Computing Indices

No matter how meticulously the standardized method for taking photographs was followed it is inevitable that errors will occur (see Chapter 4). The measurements obtained were converted into absolute measurements using the scale positioned alongside the head in each of the photographs. This scale cannot, however, be explicit about every--thing and there must be doubts regarding the uniformity of the stand--ardized photographs. Quality of measurements depends on many factors; the position of the head, lighting, quality of facial contours etc., as described in the last chapter. It is, therefore, useful to work out ratios, or indices, for each view. The indices I chose compared measurements each from the same view thus providing an index which was independant of scaling effects. A small number of indices using measurements taken from both frontal and profile views were also com--puted but to minimize errors of combining measurements from the two a General Facial Size Factor was calculated as formulated by Brothwell and Harvey (1965). In addition to this some of the Tanzanian photo-graphs were supplied without scales being present as were the photo-

-graphs taken from Fülleborn. Absolute measurements could not be calculated from these but indices from front and profile views treated separately could be because these were independant of scaling. Angles and relationships also did not have to be converted to absolute and could be obtained from these photographs.

The indices which were computed are shown in sections 5.2(i) -(iii) along with the measurements used in their calculation. The com- -puter allows any new variables, in this case the indices, which are arithmetic functions of one or more of variables presently in the file, in this case the measurements. The index may be computed by adding, subtracting, dividing, multiplying or in some other way operating on one or more of the variables. To carry this out the control word COMPUTE is entered followed by the name of the computed variable, in short coded form. and the arithmetic expression to be used to compute that variable is placed to the right of the equal sign.

Therefore, for the first index computed in Section 5.2(i) it would be entered thus:-

COMPUTE EPIX = BIZYGOMATIC DIA. ÷ BIAURAL BRDTH.

where EPIX is the Ear Protrusion Index.

5.2(i) - Indices using Front View only

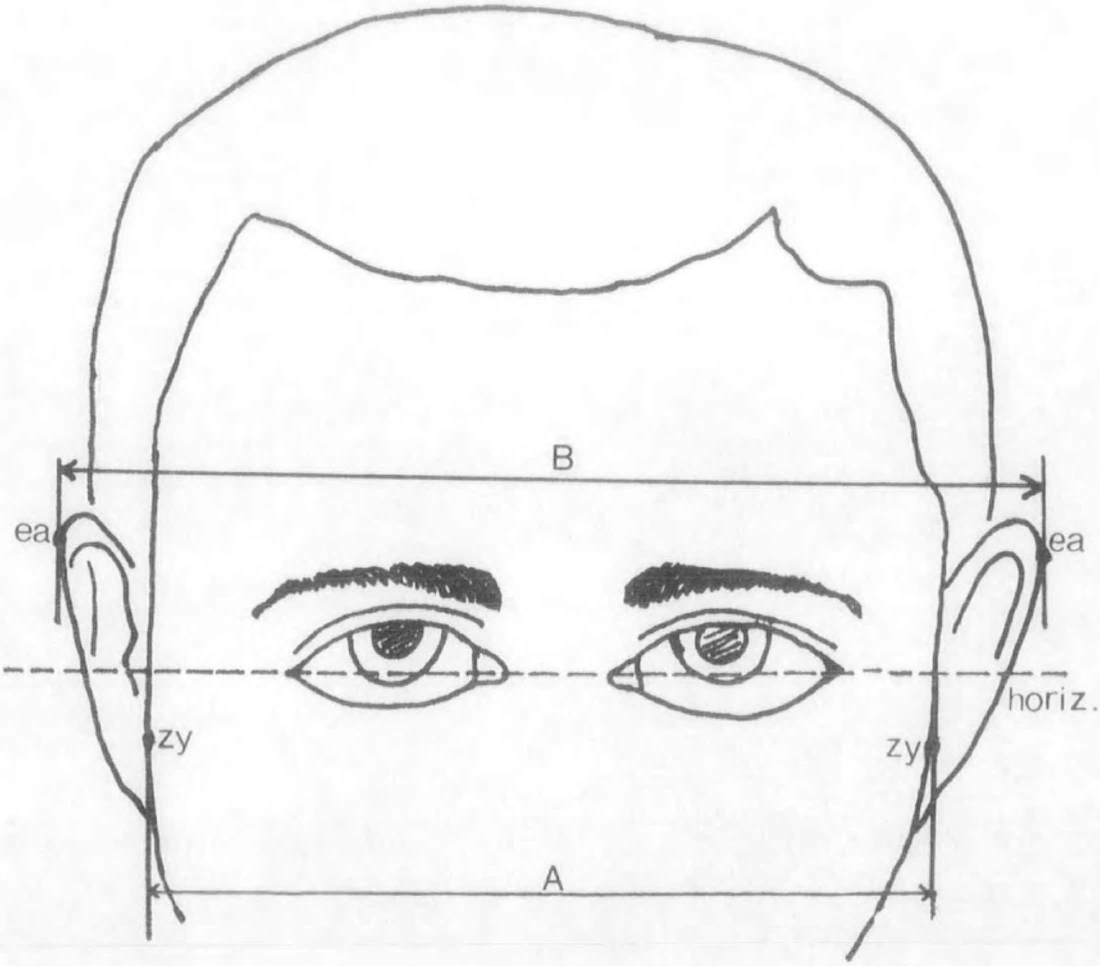
Index 1 Ear Protrusion Index

$$\text{Ear Protrusion Index} = \frac{\text{Bizygomatic Diameter (zy - zy)}}{\text{Biaural Breadth (ea - ea)}}$$

$$\text{In Figure 5.1 Ear Protrusion Index} = \frac{A}{B}$$

$$\text{or from Chapter 3 Ear Protrusion Index} = \frac{\text{Measurement 1}}{\text{Measurement 2}}$$

Figure 5.1 Measurements used for Ear Protrusion Index



Indices 2 and 3 are concerned with comparing parts of the mouth to one another.

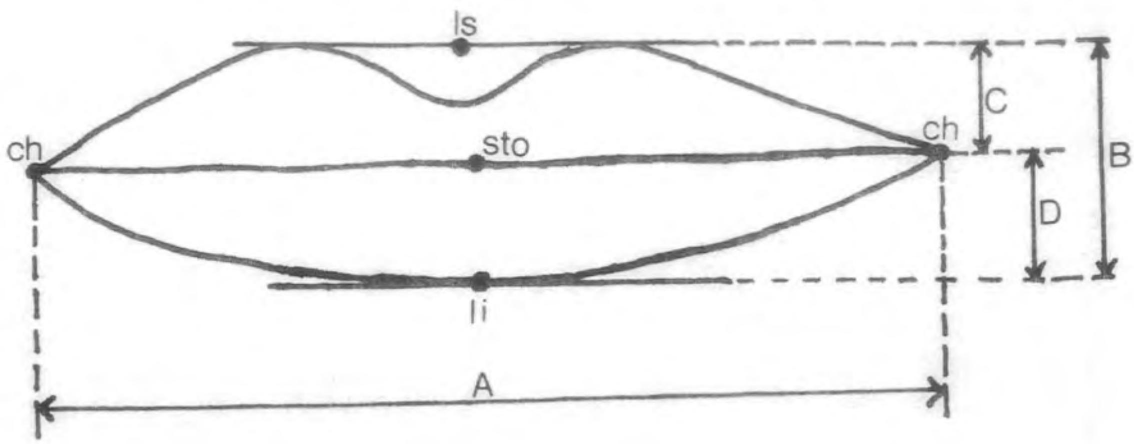
Index 2 Mouth Index

$$\text{Mouth Index} = \frac{\text{Mouth width (ch - ch)}}{\text{Total height of lips (ls - li)}}$$

In Figure 5.2 Mouth Index = $\frac{A}{B}$ or using the notation in Chpt.3.

$$\text{Mouth Index} = \frac{\text{Measurement 6}}{\text{Measurement 9}}$$

Figure 5.2 Measurements used for Mouth Index and Lip Index



Index 3 Lip Index

$$\text{Lip Index} = \frac{\text{Upper Lip Height (ls - sto)}}{\text{Lower Lip Height (sto - li)}}$$

In Figure 5.2 Lip Index = $\frac{C}{D}$

or using notation in Chpt. 3., Lip Index = $\frac{\text{Measurement 7}}{\text{Measurement 8}}$

Index 4 Eye Fissure Index

$$\text{Eye Fissure Index} = \frac{(\text{Right Eye Fissure Width + Left Eye Fissure Width (en - ex)})}{(2)} \div \frac{(\text{Right Eye Fissure Height + Left Eye Fissure Height(ps - pi)})}{(2)}$$

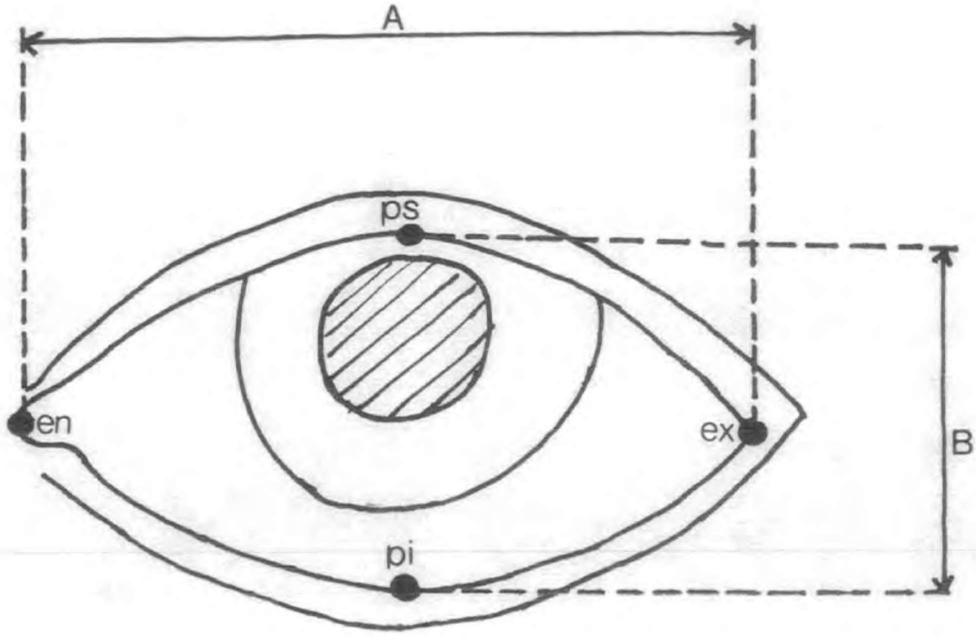
OR Eye Fissure Index

From Figure 5.3 = $\frac{(\text{Right A + Left A})}{(2)} \div \frac{(\text{Right B + Left B})}{(2)}$

or Using the notation in Chapter 3

$$\text{Eye Fissure Index} = \frac{\left(\frac{\text{Measurement 12} + \text{Measurement 13}}{2}\right)}{\left(\frac{\text{Measurement 10} + \text{Measurement 11}}{2}\right)}$$

Figure 5.3 Showing Measurements used in computing Eye Fissure Index (Left Eye Only)



Index 5 Occular Index

$$\text{Occular Index} = \frac{\text{Bioccular Diameter (ex - ex)}}{\text{Inter-occular Distance (en - en)}}$$

$$\text{In Figure 5.4} = \frac{A}{B}$$

or using notation in Chapter 3, $\text{Occular Index} = \frac{\text{Measurement 5}}{\text{Measurement 4}}$

Indices 6 - 9 are width indices of various facial features compared with the Bizygomatic Diameter in each case.

Index 6 Mouth Width Index

$$\text{Mouth Width Index} = \frac{\text{Bizygomatic Diameter (zy - zy)}}{\text{Mouth Width (ch - ch)}}$$

$$\text{From Figure 5.4} = \frac{C}{E}$$

Using the notation in Chapter 3, Mouth Width Index

$$= \frac{\text{Measurement 1}}{\text{Measurement 6}}$$

Index 7 Nasal Breadth Index

$$\text{Nasal Breadth Index} = \frac{\text{Bizygomatic Diameter (zy - zy)}}{\text{Nasal Breadth (al - al)}}$$

$$\text{From Figure 5.4} = \frac{C}{D}$$

or using the notation in Chapter 3 $= \frac{\text{Measurement 1}}{\text{Measurement 3}}$

Index 8 Inter-occular Width Index

$$\text{Inter-occular Width Index} = \frac{\text{Bizygomatic Diameter (zy - zy)}}{\text{Inter-occular Distance (en - en)}}$$

$$\text{From Figure 5.4} = \frac{C}{B}$$

Using notation in Chapter 3 $= \frac{\text{Measurement 1}}{\text{Measurement 4}}$

Index 9 Bioccular Width Index

$$\text{Bioccular Width Index} = \frac{\text{Bizygomatic Diameter (zy - zy)}}{\text{Bioccular Diameter (ex - ex)}}$$

$$\text{From Figure 5.4} = \frac{C}{A}$$

or using notation in Chapter 3 $= \frac{\text{Measurement 1}}{\text{Measurement 5}}$

Indices 10 - 12 are the widths of various facial features compared with each other.

Index 10 Mouth - Nose Width Index

$$\text{Mouth - Nose Width Index} = \frac{\text{Mouth Width (ch - ch)}}{\text{Nasal Breadth (al - al)}}$$

$$\text{From Figure 5.4} = \frac{E}{D}$$

$$\text{or using notation in Chapter 3} = \frac{\text{Measurement 6}}{\text{Measurement 3}}$$

Index 11 Bioccular - Mouth Width Index

$$\text{Bioccular - Mouth Width Index} = \frac{\text{Bioccular Diameter (ex - ex)}}{\text{Mouth Width (ch - ch)}}$$

$$\text{From Figure 5.4} = \frac{A}{E}$$

$$\text{Using notation in Chapter 3} = \frac{\text{Measurement 5}}{\text{Measurement 6}}$$

Index 12 Inter-occular - Nasal Width Index

$$\text{Inter-occular - Nasal Width Index} = \frac{\text{Inter-occular Distance (en - en)}}{\text{Nasal Breadth (al - al)}}$$

$$\text{From Figure 5.4} = \frac{B}{D}$$

$$\text{Using the notation in Chapter 3} = \frac{\text{Measurement 4}}{\text{Measurement 3}}$$

5.2(ii) - Indices using Profile View only

Indices 13 - 18 use vertical heights of part of face to compare proportions.

Index 13 Upper Face - Forehead Height Index

$$\text{Upper Face - Forehead Height Index} = \frac{\text{Height of Upper Face (sci - sn)}}{\text{Height of Forehead (tr - sci)}}$$

$$\text{From Figure 5.5} = \frac{B}{A}$$

$$\text{Using the notation from Chapter 3} = \frac{\text{Measurement 20}}{\text{Measurement 19}}$$

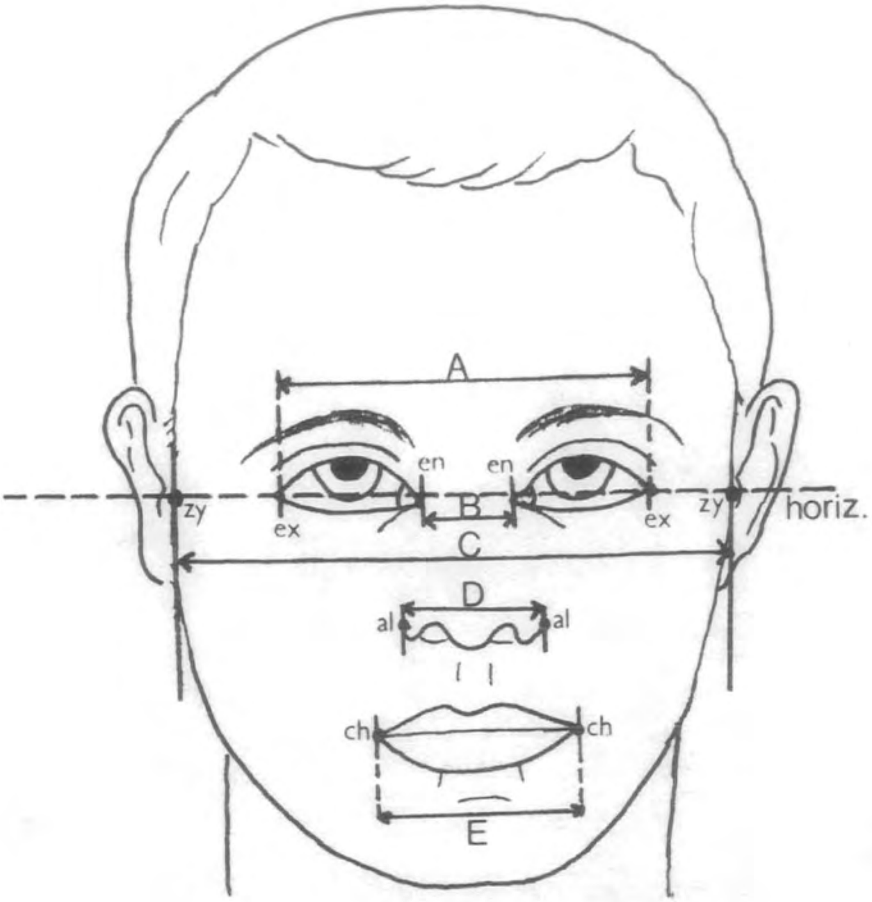


Figure 5.4 Showing measurements used in computing indices numbers 5 - 12

Index 14 Upper - Lower Facial Height Index

Upper - Lower Facial Height Index = $\dfrac{\text{Height of Upper Face (sci - sn)}}{\text{Vertical Height of Lower Face (sn - gn)}}$

From Figure 5.5 = $\dfrac{B}{C}$

Using the notation from Chapter 3 = $\dfrac{\text{Measurement 20}}{\text{Measurement 18}}$

Index 15 Lower Face - Forehead Height Index

Lower Face - Forehead Height Index = $\dfrac{\text{Vertical Height of Lower Face (sn - gn)}}{\text{Height of Forehead (tr - sci)}}$

From Figure 5.5 = $\dfrac{C}{A}$

Using the notation from Chapter 3 = $\dfrac{\text{Measurement 18}}{\text{Measurement 19}}$

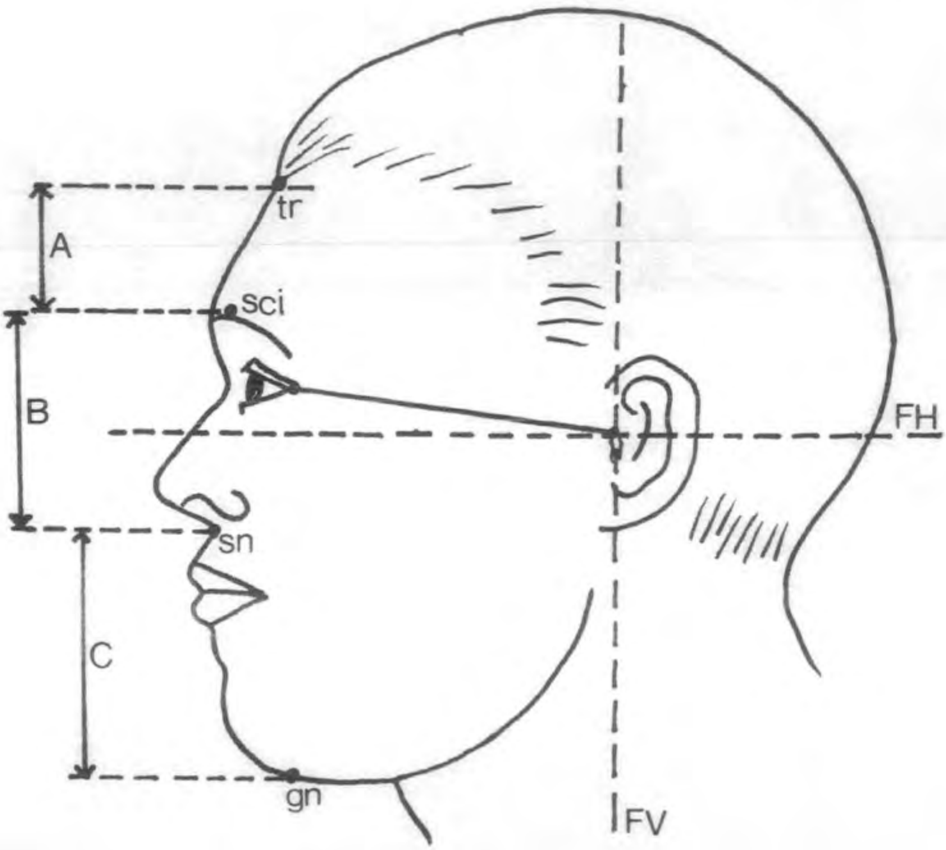


Figure 5.5 Measurements used for Indices 13 - 15

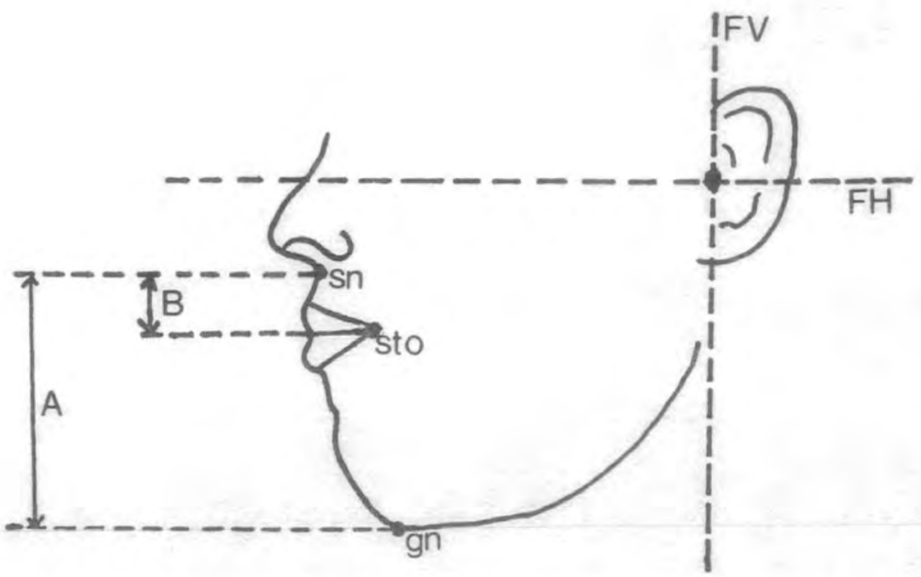
Index 16 Lower Facial Proportion Index

$$\text{Lower Facial Proportion Index} = \frac{\text{Vertical Height of Lower Face (sn - gn)}}{\text{Height of Whole Upper Lip (sn - sto)}}$$

From Figure 5.6 = $\frac{A}{B}$

or using the notation in Chapter 3 = $\frac{\text{Measurement 18}}{\text{Measurement 17}}$

Figure 5.6 Showing measurements used in calculating Lower Facial Pro--portion Index



Index 17 Nasal Height - Prominence Index

$$\text{Nasal Height - Prominence Index} = \frac{\text{Nasal Height (n - sn)}}{\text{Nasal Prominence (prn - ap)}}$$

From Figure 5.7 = $\frac{A}{B}$

Using notation in Chapter 3, Nasal Height - Prominence

Index = $\frac{\text{Measurement 16}}{\text{Measurement 14}}$

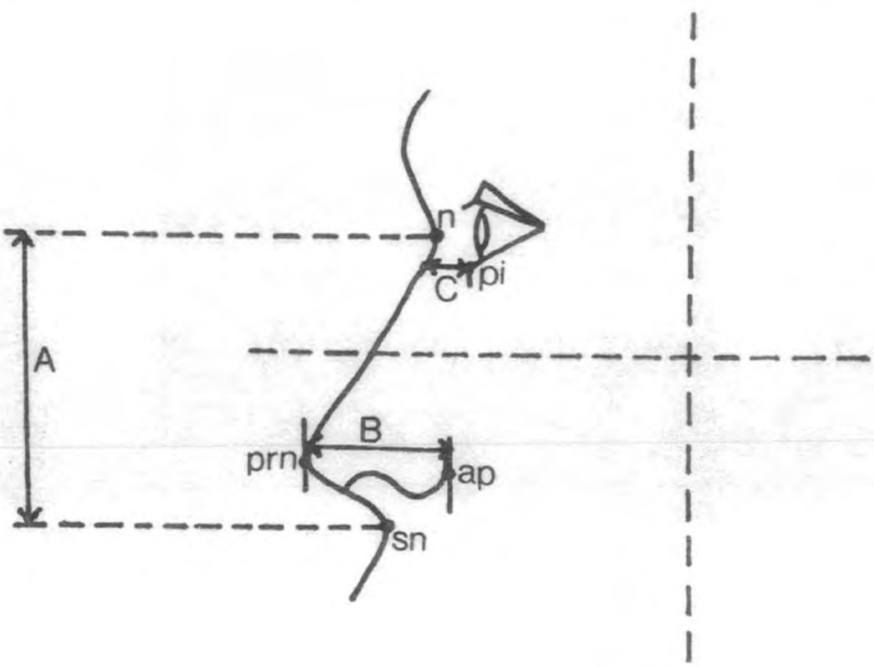
Index 18 Nasal Prominence - Bridge Index

Nasal Prominence - Bridge Index = $\frac{\text{Nasal Prominence}}{\text{Nasal Bridge Distance}}$

From Figure 5.7 = $\frac{B}{C}$

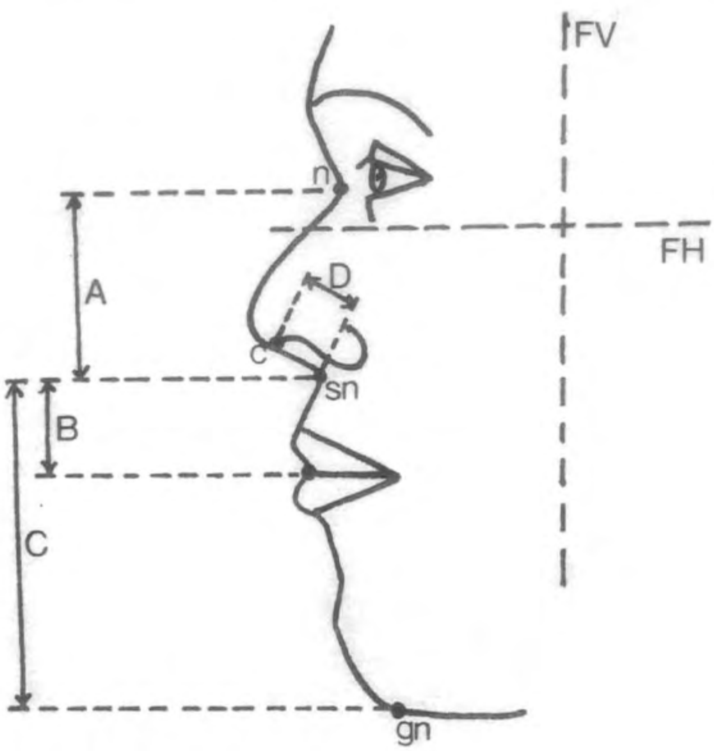
Using notation in Chapter 3 = $\frac{\text{Measurement 14}}{\text{Measurement 15}}$

Figure 5.7 Measurements used in calculating Indices 17 and 18



Indices 19 and 20 both use the Vertical Height of the nose for comparison purposes. In each case a vertical measurement of the face is

Figure 5.8 Showing measurements used for calculating Indices 19 - 21



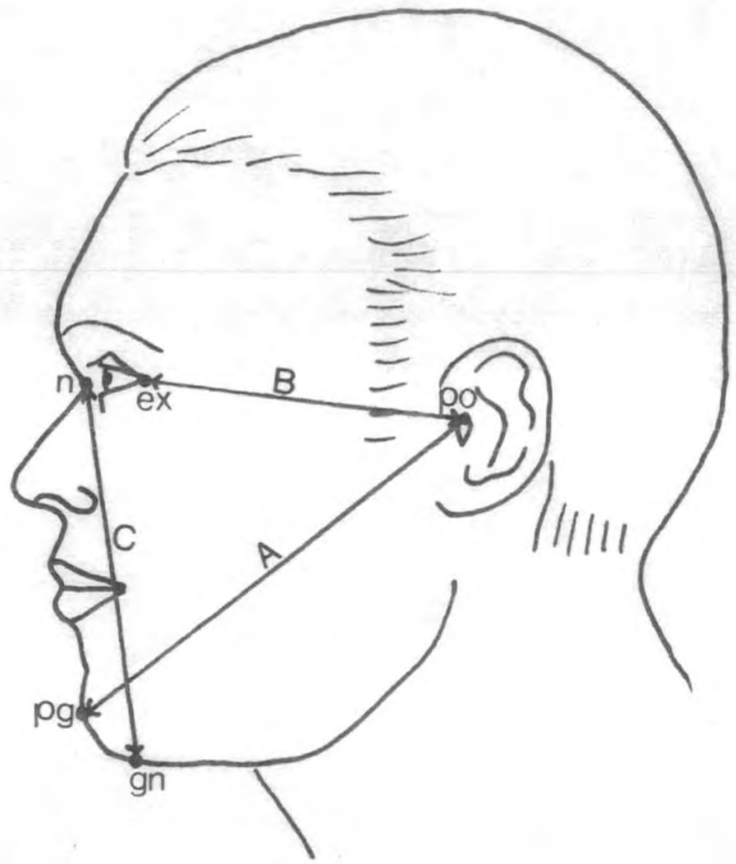


Figure 5.9 Showing lateral measurements used in Indices 23 - 27

compared with the nasal height giving a vertical index.

Index 19 Whole Upper Lip Vertical Index

$$\text{Whole Upper Lip Vertical Index} = \frac{\text{Nasal Height (n - sn)}}{\text{Height of Whole Upper Lip (sn - sto)}}$$

$$\text{From Figure 5.8} = \frac{A}{B}$$

$$\text{or using the notation in Chapter 3} = \frac{\text{Measurement 16}}{\text{Measurement 17}}$$

Index 20 Lower Facial Height Vertical Index

$$\text{Lower Facial Height Vertical Index} = \frac{\text{Vertical Height of Lower Face (sn - gn)}}{\text{Nasal Height (n - sn)}}$$

$$\text{From Figure 5.8} = \frac{C}{A}$$

$$\text{or using the notation in Chapter 3} = \frac{\text{Measurement 18}}{\text{Measurement 16}}$$

Index 21 Nasal Columella Length Index

Here again the nasal height is used for comparison purposes but in this case a lateral measurement is compared to it.

$$\text{Nasal Columella Length Index} = \frac{\text{Nasal Height (n - sn)}}{\text{Columella Length (c - sn)}}$$

$$\text{From Figure 5.8 Nasal Columella Length Index} = \frac{A}{D}$$

$$\text{or using the notation in Chapter 3} = \frac{\text{Measurement 16}}{\text{Measurement 24}}$$

Indices 22, 23 and 24 are comparisons between the three main lateral measurements of the face which are used for producing the General Facial Size Factor (Index 27). Note that the Height of Face used in these indices is a lateral not a vertical measurement (i.e. it is measurement no. 23 not no. 18) though both are measured between same landmarks n and gn.

Index 22 Lateral Proportion Index I

$$\text{Lateral Proportion Index I} = \frac{\text{Auricle - Chin Distance (po - pg)}}{\text{Orbit - Auricle Distance (ex - po)}}$$

From Figure 5.9 $= \frac{A}{B}$

or using the notation in Chapter 3 $= \frac{\text{Measurement 22}}{\text{Measurement 21}}$

Index 23 Lateral Proportion Index II

$$\text{Lateral Proportion Index II} = \frac{\text{Height of Face (n - gn)}}{\text{Orbit - Auricle Distance (ex - po)}}$$

From Figure 5.9 $= \frac{C}{B}$

or using the notation in Chapter 3 $= \frac{\text{Measurement 23}}{\text{Measurement 21}}$

Index 24 Lateral Proportion Index III

$$\text{Lateral Proportion Index III} = \frac{\text{Auricle - Chin Distance (po - pg)}}{\text{Height of Face (n - gn)}}$$

From Figure 5.9 $= \frac{A}{C}$

or using the notation in Chapter 3 $= \frac{\text{Measurement 22}}{\text{Measurement 23}}$

Index 25 Nasal Prominence Lateral Index

$$\text{Nasal Prominence Lateral Index} = \frac{\text{Auricle - Chin Distance (po - pg)}}{\text{Nasal Prominence (prn - ap)}}$$

From Figure 5.10 $= \frac{A}{C}$

Using the notation in Chapter 3 $= \frac{\text{Measurement 22}}{\text{Measurement 14}}$

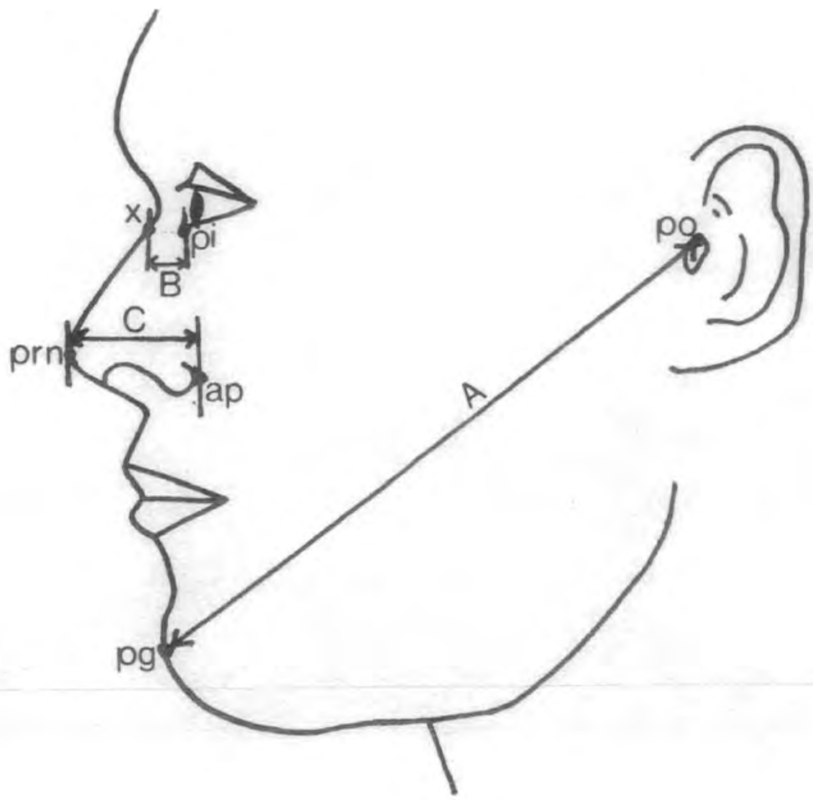
Index 26 Nasal Bridge Distance Lateral Index

$$\text{Nasal Bridge Distance Lateral Index} = \frac{\text{Auricle - Chin Distance (po - pg)}}{\text{Nasal Bridge Distance (pi - r)}}$$

From Figure 5.10 = $\frac{A}{B}$

Using the notation in Chapter 3 = $\frac{\text{Measurement 22}}{\text{Measurement 15}}$

Figure 5.10 For Indices 25, 26, 28 and 29



5.2(iii) - Indices using measurements from both Front and Profile Views

Index 27 General Facial Size Factor

G.F.S.F. = (Orbit-Auricle Dist. + Height of Face + Auricle-Chin Dist. + Bizygomatic Diameter) ÷ 100

Using notation in Chapter 3 = (Meas.21 + Meas.23 + Meas.22 + Meas.1) ÷ 100

The Orbit-Auricle Distance, Height of Face and Auricle-Chin Distance are all made from the Profile (lateral) view and are shown in

Figure 5.9 (B, C and A respectively). The Bizygomatic Diameter measure--ment, however, is made from the frontal view and is shown as measure--ment A in Figure 5.1. The General Facial Size Factor Index was form--ulated by Brothwell and Harvey (1965) although they are rather confus--ing in their writing concerning the first measurement used. In the text the first measurement used is defined as - "The distance between top of ear-hole and outer corner of eye" (p.180) while on a diagram (Fig. 1., p.168) the first measurement is shown from the nasion to the top of the ear-hole. Farkas (1981) uses both measurements in his work but concludes that the first (i.e. from corner of eye to top of ear--hole) is the most reliable. He does not, however, refer to the work of Brothwell and Harvey. I have therefore, used the distance from outer corner of eye (ex) to top of ear-hole (po) for my measurement.

Indices 28 and 29 use the General Facial Size Factor Index for comparison purposes and along with Index 30 are all formulated by Brothwell and Harvey (1965).

Index 28 Nasal Bridge Index

$$\text{Nasal Bridge Index} = \frac{\text{Nasal Bridge Distance}}{\text{General Facial Size Factor}}$$

Nasal Bridge Distance is shown in Figure 5.10 as measurement 13 and in Chapter 3 as measurement 15.

The General Facial Size Factor is calculated as for Index 27.

Index 29 Nasal Prominence Index

$$\text{Nasal Prominence Index} = \frac{\text{Nasal Prominence}}{\text{General Facial Size Factor}}$$

Nasal Prominence is shown in Figure 5.10 as measurement C and in Chapter 3 is measurement 14.

The General Facial Size Factor is Index 27 above.

Index 30 Nasal Index

$$\text{Nasal Index} = \frac{\text{Nasal Height (n - sn)}}{\text{Nasal Breadth (al - al)}}$$

Nasal Height is measured on the Profile print.

Nasal Breadth is measured on the Frontal print.

In Chapter 3 Nasal Height is measurement number 16 and Nasal Breadth is measurement number 3. Nasal Height is shown as measurement A in Figure 5.8 and Nasal Breadth as measurement D in Figure 5.4.

Table 5.1 shows the Indices calculated and the measurements used for each one.

Table 5.1 Indices Calculated

INDEX NO.	INDEX NAME	MEASUREMENTS USED
Front Only		
1	Ear Protrusion Index	Bizygomatic Diam. ÷ Biaural Brdth.
2	Mouth Index	Mouth Width ÷ Tot. Height of Lips
3	Lip Index	Upper Lip Ht. ÷ Lower Lip Ht.
4	Eye Fissure Index	$\left(\frac{\text{L+R Eye Fiss Wdth}}{2}\right) \div \left(\frac{\text{L+R Eye Fiss Ht.}}{2}\right)$
5	Occular Index	Biocular Diam. ÷ Inter-Occ. Dist.
6	Mouth Width Index	Bizygomatic Diam. ÷ Mouth Width.
7	Nasal Breadth Index	Bizygomatic Diam. ÷ Nasal Brdth.
8	Inter-Occular Width Index	Bizygomatic Diam. ÷ Inter-Occ Dist.
9	Bioccular Width Index	Bizygomatic Diam. ÷ Bi-Occ Diam.
10	Mouth-Nose Width Index	Mouth Width ÷ Nasal Breadth
11	Bioccular-Mouth Width Index	Bioccular Diam. ÷ Mouth Width
12	Interoccular-Nasal Wdth Index	Interoccular Dist. ÷ Nasal Brdth.
Profile Only		
13	Upper Face-Forehead Ht. Index	Ht.of Upper Face ÷ Ht. of Forehead
14	Upper-Lower Facial Ht. Index	Ht.of Upp.Face ÷ Vert.Ht.Lower Fce.
15	Lower Face-Forehead Ht. Index	Vert.Ht.Lower Face ÷ Ht.of ForeHd.
16	Lower Face Proportion Index	Vert.Ht.Lower Face ÷ Ht.Whole Upp. Lip
17	Nasal Ht. Prominence Index	Nasal Ht. ÷ Nasal Prominence
18	Nasal Prominence-Bridge Index	Nasal Prominence ÷ Nasal Brid.Dist.
19	Whole Upp.Lip Vertical Index	Nasal Ht. ÷ Ht.Whole Upper Lip
20	Lower Facial Ht. Vert. Index	Vert.Ht.Low. Face ÷ Nasal Height
21	Nasal Columella Length Index	Nasal Ht. ÷ Columella Length
22	Lateral Proportion Index I	Auricle-Chin Dist.÷ Orbit Aur.Dist
23	Lateral Proportion Index II	Ht.of Face ÷ Orbit-Auricle Dist.
24	Lateral Proportion Index III	Auricle-Chin Dist.÷ Ht. of Face
25	Nasal Prominence Lat. Index	Auricle-Chin Dist.÷ Nasal Prom.
26	Nasal Bridge Dist.Lat. Index	Auricle-Chin Dist.÷Nasal Brid.Dist.
Front and Profile		
27	Gen. Facial Size Factor Index	$\frac{\text{(Orbit-Auricle Dist.+ Ht.of Face + Auricle-Chin Dist.+Bizygomatic Dia.)}}{100}$

Table 5.1 Indices Calculated continued

INDEX NO.	INDEX NAME	MEASUREMENTS USED
Front and Profile		
28	Nasal Bridge Index	Nasal Bridge Dist. ÷ G.F.S.F
29	Nasal Prominence Index	Nasal Prominence ÷ G.F.S.F.
30	Nasal Index	Nasal Ht. ÷ Nasal Breadth

5.3 - Grouping Individuals

Each subject was coded for sex and age as well as for tribe, in the case of Tanzanian subjects, or for subject's birthplace for British subjects. Therefore, each individual in the computer file bore a code for his or her sex, age range (i.e. adult or juvenile) and a subject locator code based on tribe or birthplace.

Groups of individuals could be selected by using the subject locator so that populations for specific tribes or regions could be selected. These groups could be further combined to make larger groups as required. Within each of the groups created it was also possible to select for sex and age range. The populations selected and the combina--tions used are shown in Table 5.2.

Table 5.2 Populations Used

Population No.	Title:-	Composed of:-
1	Hehe (Direct)	
2	Hehe (Absolute)	
3	Kinga (Direct)	
4	Kinga (Absolute)	
5	Nyakyusa (Direct)	
6	Nyakyusa (Absolute)	
7	Tutsi (Absolute)	
8	Sukuma (Absolute)	
9	Hehe (Dir. + Abs.)	Pops. 1 + 2
10	Kinga (Dir. + Abs.)	Pops. 3 + 4
11	Nyakyusa (Dir. + Abs.)	Pops. 5 + 6
12	Tanzania (Absolute)	Pops. 2 + 4 + 6 + 7 + 8
13	Tanzania (Dir. + Abs.)	Pops. 1 + 3 + 5 + 12
14	N.E. of Gt. Britain (Abs.)	
15	Rest of Gt. Britain (Abs.)	
16	Great Britain (Absolute)	Pops. 14 + 15
17	All Cases (Absolute)	Pops. 12 + 16
18	All Cases (Dir. + Abs.)	Pops. 13 + 16

5.4 - Descriptive Statistics

The first stage in the analysis of data was to determine the basic distributional characteristics of each of the variables (the measurements and indices) to be used in subsequent statistical analysis. Information on the distribution, variability and central tendencies of the variables was obtained using the subprograms CONDESCRIPTIVE and FREQUENCIES. The former was used for all of the measurements and indices apart from the relationships which were analysed using the latter subprogram. The condescriptive subprogram provided the following summary statistics.

(i) Number of Cases (n) - the number of subjects in a particular population.

(ii) Minimum and Maximum - these denote the smallest and largest value of a variable encountered among the cases. The range can be obtained by subtracting the minimum from the maximum.

(iii) Mean ($\bar{x}$) - this is the most common measure of central tendency, it is often referred to as the "average" and is the sum of the individual values for each case divided by the number of cases. It can be found by the formula :-

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \qquad \text{or} \qquad \bar{x} = \frac{\sum x}{n}$$

Where x_i equals the score for each case and n equals the number of valid cases, x stands for the values of the different items in the distribution.

(iv) The Standard Deviation (σ) - is a measure of the degree of dispersion around the mean. It is found by adding the square of the deviations of the individual values from the mean of the distribution, dividing this sum by the number of items in the distribution and then finding the square root of the quotient.

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

The greater the dispersion, the larger the standard deviation will be.

(v) <u>Standard Error ($\sigma \bar{x}$)</u>

The standard error of the mean $\sigma_{\bar{x}}$ is calculated by dividing the standard deviation by the square root of the number of cases.

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

The standard error helps to determine the potential degree of discrepancy between the sample mean and the unknown population mean.

(vi) <u>Skewness</u> - is a statistic needed to determine the degree to which a distribution of cases approximates a normal curve, since it measures deviations from symmetry. The measure of skewness will take on a value of zero when the distribution is a completely symmetrical bell - shaped curve. A positive value indicated that the cases are clustered more to the left of the mean with most of the extreme values to the right. A negative value indicates clustering to the right. The larger the number the greater the degree of skews.

$$\text{SKEWNESS} = \frac{\sum_{i=1}^{n} \left[(x_i - \bar{x}) / s \right]^3}{n}$$

(vii) <u>Kurtosis</u> - which is a measure of the relative peakedness or flatness of the curve defined by the distribution of cases. A normal distribution will have a kurtosis of zero. If the kurtosis is positive then the distribution is more peaked (narrow) than would be true for a normal distribution, while a negative value means that is is flatter.

Kurtosis is computed using the following formula:-

$$\text{KURTOSIS} = \frac{\sum_{i=1}^{n} \left[(x_i - \bar{x})/s\right]^4}{n} - 3$$

For both Skewness and Kurtosis the one - tailed 1 percent and 5 percent significance levels of the figures given in the computer printout can be found using Tables for Testing Skew--ness and for Kurtosis. The figures given are compared in relation to sample size. The tables used in this study are those in Snedecor and Cochran (1967).

(viii) Frequency Distributions

For the various relationships of one particular facial characteristic to the horizontal or vertical (i.e. Nasal Wing-Septum Relationship, Frontal, Nasal, Labial and Mandibular Protraction or Retraction) the percentage of the total number of cases occuring in each of the categories was computed. This method was used because the relationships were discontinuous values rather than the continuous variation shown in the rest of the measurements taken. In these each of the anthroscopic observations was placed into one of eight categories in the case of the Nasal Wing-Septum Relationships or into one of three categories in the other relationships observed. This was carried out using the sub-program 'FREQUENCIES' while the other descriptive statistics were computed using the 'CONDESCRIPTIVE' sub-program.

5.5 - Comparison of Sample Means - the Mann - Whitney U Test

After determining the basic distributional characteristics as described the next stage was to determine whether or not the means of samples taken from different populations were significantly different from one another for each of the variables measured. From the measure--ments of Skewness and Kurtosis it was found that the samples taken did not have normal distribution. Therefore, a nonparametric test was chosen for the comparison of the sample means. Nonparametric means that no assumptions are made about the distribution of cases on the variables. Many statistical procedures require assumptions about the underlying distributions of variables, for example, the t - test, which would have been used had there been a normal distribution, is used to test whether two samples have the same mean but assumes that both samples are from two normally distributed populations which have the same variance. Nonpara-metric or "distribution free" procedures make only minimal assumptions about the form of the underlying distribution.

The test chosen for the comparison of sample means was the Mann - Whitney U Test. This is used to test whether two independent groups have been drawn from the same population. This is one of the most powerful of the nonparametric tests and is, therefore, a most useful alternative to the parametric t-test avoiding the t-test's assumptions.

The method used in this test is to combine the two groups and then the cases are ranked in order of increasing size. The value of U (the statistic used in this test) is computed as the number of times a score from group A precedes a score from group B. The rationale is that if the samples are from the same population, the distribution of the scores from the two groups in the ranked list will be random, a non-random pattern will be indicated by an extreme value of U.

For small samples (less than 30 cases) the exact significance level of U is computed using the alogarithm of Dineen and Blakesley (1973). For larger samples U is transformed into a normally distributed statistic, Z (corrected for ties) and its two - tailed probability is given.

5.6 - Discriminant Analysis

From the last test it was seen that many groups (populations) were significantly different for various variables. The next procedure carried out was Discriminant Analysis, the object of which was to determine which variables caused two or more populations to differ. In other words we use this procedure because we want to be able to "dis--criminate" between the groups in the sense of being able to tell them apart. To distinguish between the groups the discriminating variables are weighted and linearly combined so that the groups are forced to be statistically as distinct as possible. This is done as a stepwise method removing variables and replacing them in turn, so selecting the "best" set of discriminating variables causing the groups to be as dis--tinct as possible. The method used for controlling the stepwise sel--ection was the minimum Mahalanobis distance between groups. Whereas the methods before were univariate methods of data analysis (i.e. use one variable at a time), the procedure used here, Discriminant Analysis, is a method of multivariate data analysis.

The method used in Discriminant Function Analysis is best initially explained in terms of two separate groups, the object of which is to allow an individual to be placed in one or other of the groups on the basis of a set of K variables. This amounts to finding a linear equation which will maximise some pre-determined requisite taken to be indicative of between - group separation.

The linear function between two groups is defined by Blackith and Reyment (1971) as :-

$$Y = (\bar{x}_1 - \bar{x}_2)' S^{-1} x$$

Where $\bar{x}_1$ and $\bar{x}_2$ are the mean vectors of sample size N_1, N_2. S^{-1} is the reciprocal of the pooled sample dispersion matrix (variance / co-variance matrix) and x is the vector of variables.

The coefficients of the linear discriminant functions are defined as :-

$$a = S^{-1}(\bar{x}_1 - \bar{x}_2)$$

These functions are related to the Mahalanobis generalised distance by the relationship :-

$$D^2 = (\bar{\bar{x}}_1 - \bar{\bar{x}}_2)' S^{-1} (\bar{\bar{x}}_1 - \bar{\bar{x}}_2) = d'a$$

Where d is the difference between two sample mean vectors. This formula can be extended to cover any number of intergroup relationships.

The particular program used for discriminant analysis in this investigation is that produced by the S.P.S.S. statistical package system and termed DISCRIMINANT (Nie et al., 1970). For reference to the D^2 statistic see Mahalanobis, 1936 and Rao, 1952.

One of the outputs from the program DISCRIMINANT is on F matrix together with the associated degrees of freedom. A classification array is obtained which shows the percentage of cases in each known group which would be correctly placed in that group on the basis of the discriminant functions alone. The relative importance of such function in the discriminating process can be examined by considering the eigen values or the canonical correlations (c.c.), the program deriving the functions in decreasing order of importance as judged by the amount of explained variance contained within each function. The maximum number of functions is always one less than the number of groups, but with several groups a few functions (2 or 3) should classify the individual cases into their correct groups.

5.7 - Factor Analysis

This is a method of data - reduction performed on the data in the computer file. Factor analysis enables us to see whether some underlying pattern of relationships exists such that the data may be rearranged or "reduced" to a smaller set of "factors" that may be taken as source variables accounting for the observed interrelations in the data. There are three main steps to factor analysis; first the preparation of the correlation matrix; second, the extraction of the initial factors - the exploration of possible data reduction; and third, the rotation to a terminal solution - the search for sample and interpretable factors.

Factor analysis, or principal component / co-ordinate analysis, therefore, attempts to find a reduced number of factors or components (R) which will explain the variance contained within the correlation matrix between the original N variables ($R < N$).

The program used for the factor analysis in this study is part of the S.P.S.S. package and is program FACTOR.

As stated above the first step in factor analysis involves the calculation of appropriate measures for a set of relevant variables. The variety of factor analysis carried out is known as R- factor analysis since it is based on correlation between variables rather than on units (objects, individuals, communities etc.) which would be termed Q- factor analysis. The user has first to define the relevant universe of analysis since the nature and scope of the variables included in the analysis have crucial implications for the factor results and their possible interpreta--tion.

The second step in factor analysis isto explore the data-re--duction possibilities by constructing a new set of variables on the basis of the interrelations exhibited in the data. In doing so, the new variables may be defined as exact mathematical transformations of the original data, a method known as principal - component analysis. The initial factors are extracted in such a way that one factor is independent from the other, i.e. the factors are orthogonal.

Prinicipal - component analysis is a relatively straightforward method of transforming a given set of variables into a new set of com--posite variables or principal components that are orthogonal to each other. The "best" linear combination is chosen. "Best" in the sense that the particular combination of variables would account for more of the variance in the data as a whole than any other linear combination of variables. The first principal component, therefore, may be defined as the single best summary of linear relationships exhibited in the data. The second component is defined as the second best linear combination of variables. Since it is a condition that the second component is orthogonal to the first, then, the second one must account for the pro--portion of variance not accounted for by the first component. Thus, the second component is the linear combination of variables which accounts for the most residual variance after the effect of the first component is removed from the data. Subsequent components are defined simarly until all the variance in the data is exhausted. The principal component model may be expressed as :-

$$Zj = aj_1 \ F_1 + aj_2 \ F_2 + \ldots\ldots\ldots + ajn \ Fn$$

where each of the n observed variables is described linearly in terms of n new uncorrelated components F_1, F_2 ..... Fn each of which is in turn defined as a linear combination of the n original variables.

Since each component is defined as the best linear summary of variance left in the data after the previous components are taken care of, the first components may explain most of the data. For factor - - analytical purposes, therefore, only the first few components are re--tained for further rotation.

The final step in factor analysis is the rotation of the factors into terminal factors. Rotation is desirable because it simpli--fies the factor structure. Two major options are available, an orthogo--nal rotational method or an oblique rotational method. The orthogonal factors are uncorrelated, while oblique factors may be correlated. The orthogonal factors are mathematically simpler to handle and this was the option chosen in the program by using sub - program option VARIMAX. Also selected was the method of factoring in subprogram FACTOR. The one chosen was that of Principal Factoring with Iteration (PA2) which replaces the main diagonal elements of the correlation matrix with communality estim--ates, the R^2 estimates. PA_2 is the most widely accepted factoring method. An output of the factor matrix and communalitos was given along with communalities, eigen values and proportion of total and common variance as statistics. In addition a plot of the rotated factors was produced using the first 3 factors only.

CHAPTER SIX - RESULTS

6.1 - Introduction

The results of the various forms of statistical analysis, as described in Chapter 5, which were performed on the data, are set out in detail in the tables contained in Appendices 2, 3, 4 and 5. Appendix 2 shows the descriptive statistics which were computed, Appendix 3 contains the results of the Mann-Whitney U Test, in Appendix 4 the results of discriminant function analysis are tabulated and Appendix 5 contains the factor analysis results.

In this chapter I will present summary tables of the results, along with relevant graphs and diagrams, interpreting and discussing them as they appear. The format which I shall adopt is to compare the various populations with one another in order that the differences and similarities between them can be determined. First, I shall compare the Tanzanian sample with the British sample, keeping the sexes separate for this com--parison. Next I shall compare the various tribes of Tanzania with each other and each separately with the rest. After this I will compare the sample of the North-East of Great Britain with the rest of Great Britain. The next comparison will be between male and female adults in the whole sample, Tanzania, Hehe, Tutsi, Great Britain, the North-East of Great--Britain and the rest of Great Britain. Finally, I shall compare age groups, adult and juvenile using Hehe and Tutsi population samples.

Within each section I shall present the descriptive statistics along with their significance levels from the Mann-Whitney U Tests. I shall first discuss the general facial pattern and proportions of parts of the face and then deal with the various features of the face. The latter approach is emphasized by Kraus et al. (1959), Brothwell and Harvey (1965), and Farkas et al. (1980) as being the most important. Studying parts of the face rather than attempting to analyse the total facial pattern in detail, is according to all of these researchers, the better approach. To enable me to carry out this more easily I have arranged the variables into sections according to which part of the face they describe. These are shown in Table 6.1 and each section will be dealt with in turn.

Table 6.1 Variables According to Region of the Face

REGION	VARIABLES	TYPE OF MEASUREMENT
HEAD AND SIZE OF FACE	Bizygomatic Diameter	Absolute
	Height of Upper Face	Absolute
	Height of Face	Absolute
	Orbit - Auricle Distance	Absolute
	Auricle - Chin Distance	Absolute
	Vertical Height of Lower Face	Absolute
	General Facial Size Factor Index	Index
FOREHEAD	Height of Forehead	Absolute
	Frontal Recession Angle	Angle
	Frontal Protraction / Retraction	Relationship
	Upper Face-Forehead Height Index	Index
	Lower Face-Forehead Height Index	Index
EYES	Inter - Occular Distance	Absolute
	Bioccular Diameter	Absolute
	Right Eye Fissure Height	Absolute
	Left Eye Fissure Height	Absolute
	Right Eye Fissure Width	Absolute
	Left Eye Fissure Width	Absolute
	Eye Fissure Index	Index
	Occular Index	Index
	Inter - Occular Width Index	Index
	Bioccular Width Index	Index
EARS	Biaural Breadth	Absolute
	Ear Protrusion Index	Index

Table 6.1 continued

REGION	VARIABLE	TYPE OF MEASUREMENT
NOSE	Nasal Breadth	Absolute
	Nasal Prominence	Absolute
	Nasal Bridge Distance	Absolute
	Columella Length	Absolute
	Nasal Height	Absolute
	Nasal Angle	Angle
	Nasal Base Angle	Angle
	Nasal Wing/Septum Relationship	Relationship
	Nasal Protraction / Retraction	Relationship
	Nasal Breadth Index	Index
	Nasal Prominence - Bridge Index	Index
	Nasal Height - Prominence Index	Index
	Nasal Columella Length Index	Index
	Nasal Prominence Lateral Index	Index
	Nasal Bridge Distance Lateral Index	Index
	Nasal Bridge Index	Index
	Nasal Prominence Index	Index
	Nasal Index	Index
	Mouth - Nose Width Index	Index
	Interoccular - Nasal Width Index	Index
MOUTH and LIPS	Mouth Width	Absolute
	Upper Lip Height	Absolute
	Lower Lip Height	Absolute
	Total Height of Lips	Absolute
	Height of Whole Upper Lip	Absolute
	Upper Lip Angle	Angle
	Labial Protraction / Retraction	Relationship
	Mouth Index	Index
	Lip Index	Index
	Mouth Width Index	Index
	Bioccular - Mouth Width Index	Index
	Whole Upper Lip Vertical Index	Index

Table 6.1 continued

REGION	VARIABLE	TYPE OF MEASUREMENT
CHIN	Chin Angle	Angle
	Mandibular Protraction/Retraction	Relationship
	Lower Face Proportion Index	Index
	Upper - Lower Face Height Index	Index
	Lower Facial Height Index	Index
LATERAL PROPORTIONS	Lateral Proportion Index I	Index
	Lateral Proportion Index II	Index
	Lateral Proportion Index III	Index

Ater this the discriminant function analysis for each of the comparisons will be discussed. The functions, or sets of variables which best discriminate between one group and another will be presented. I will also include scattergrams produced by canonical analysis to show the relationships between the various populations.

Finally, in the last section of this chapter, the results of the factor analysis will be reported. These are carried out on all of the individuals irrespective of group. The variables are selected which most contribute to the differences in facial characteristics amongst individuals.

6.2 - The Tanzanian Sample compared with the British Sample

(a) The Head and size of the Face

Table 6.2 shows the mean values and standard deviations for absolute measurements of the head and face. As can be seen from the table, 17 of the 24 absolute measurements are highly significantly larger at the 1 percent level for the Tanzanian male adults than the British male adults. Simarly 14 out of the 24 measurements for Tanzan--ian female adults are highly significantly larger than those for the

Table 6.2 Absolute Measurements - Tanzania V Great Britain

VARIABLES	MEANS AND STANDARD DEVIATION				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST			
	TANZ MA n= 190	TANZ FA n= 60	GB MA n= 99	GB FA n= 70	TANZ MA v GB MA	TANZ FA v GB FA	TANZ MA v TANZ FA	GB MA v GB FA
Bizygomat--ic Diam.	157.542 ±13.265	145.117 ±12.423	146.636 ± 8.512	138.829 ± 8.570	1%	1%	1%	1%
Biaural Breadth	183.942 ±13.921	169.017 ±11.427	182.040 ±13.565	168.203 ±10.417	-	-	1%	1%
Nasal Breadth	54.611 ± 5.950	48.233 ± 5.927	40.646 ± 3.302	37.914 ± 3.395	1%	1%	1%	1%
Inter-Occ. Distance	41.284 ± 5.123	39.317 ± 4.817	33.535 ± 4.313	32.014 ± 4.299	1%	1%	5%	5%
Bioccular Diameter	113.895 ± 9.570	105.633 ± 9.472	98.909 ± 6.299	95.100 ± 5.443	1%	1%	1%	1%
Mouth Width	74.609 ± 7.457	64.841 ± 6.228	58.091 ± 6.179	54.406 ± 5.740	1%	1%	1%	1%
Upper Lip Height	16.127 ± 2.325	13.796 ± 2.550	7.187 ± 2.059	6.712 ± 1.820	1%	1%	1%	-
Lower Lip Height	16.956 ± 2.730	15.481 ± 2.508	10.594 ± 2.856	10.034 ± 2.297	1%	1%	1%	-
Total Lip Height	33.110 ± 4.709	29.315 ± 4.304	17.729 ± 3.972	16.729 ± 3.542	1%	1%	1%	-
Right Eye Fissure Ht.	12.280 ± 2.229	11.133 ± 1.970	10.010 ± 2.003	9.418 ± 1.733	1%	1%	1%	5%
Left Eye Fissure Ht.	12.270 ± 2.328	11.333 ± 2.056	9.908 ± 1.922	9.269 ± 1.831	1%	1%	1%	5%
Right Eye Fiss.Wdth.	34.947 ± 4.092	32.733 ± 3.593	32.535 ± 3.055	31.471 ± 2.339	1%	5%	1%	5%
Left Eye Fiss.Wdth.	35.321 ± 4.220	32.383 ± 3.552	33.141 ± 2.638	31.971 ± 2.021	1%	-	1%	1%
Nasal Prominence	28.476 ± 5.181	23.224 ± 3.050	32.960 ± 3.563	29.071 ± 3.136	1%	1%	1%	1%
Nasal Brdge.Dist.	14.063 ± 4.944	12.458 ± 4.400	17.525 ± 4.956	15.686 ± 4.158	1%	1%	5%	1%
Nasal Height	50.482 ± 7.685	44.525 ± 5.036	53.545 ± 4.698	49.614 ± 4.988	1%	1%	1%	1%
Ht.of Whole Upper Lip	25.283 ± 3.780	23.186 ± 3.187	22.194 ± 2.856	20.597 ± 3.224	1%	1%	1%	1%
Vert.Ht.of Lower Face	79.550 ±10.096	71.288 ± 6.701	71.214 ± 5.298	64.114 ± 4.927	1%	1%	1%	1%
Height of Forehead	61.288 ±10.895	56.534 ± 7.526	60.768 ± 9.185	57.117 ± 9.966	-	-	1%	5%
Height of Upper Face	77.560 ±10.162	69.678 ± 6.138	71.283 ± 6.387	67.449 ± 5.438	1%	5%	1%	1%

Table 6.2 Absolute Measurements - Tanzania V Great Britain(continued)

VARIABLES	MEANS AND STANDARD DEVIATION				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST			
	TANZ MA n= 190	TANZ FA n= 60	GB MA n= 99	GB FA n= 70	TANZ MA v GB MA	TANZ FA v GB FA	TANZ MA v TANZ FA	GB MA v GB FA
Orbit-Aur. Distance	94.495 ±10.184	84.500 ± 5.753	83.333 ± 6.269	78.729 ± 5.695	1%	1%	1%	1%
Aur.-Chin Distance	157.581 ±18.913	140.034 ± 8.651	136.735 ± 8.192	124.843 ± 8.505	1%	1%	1%	1%
Height of Face	130.775 ±16.378	115.847 ± 9.253	126.735 ± 7.372	115.671 ± 8.129	-	-	1%	1%
Columella Length	8.723 ± 2.906	7.661 ± 1.688	9.847 ± 2.722	8.971 ± 2.340	1%	1%	5%	5%

Table 6.3 Indices computed using one view only - Tanzania V G. Britain

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN - WHITNEY U TEST			
	TANZ MA n= 274	TANZ FA n= 84	GB MA n= 99	GB FA n=70	TANZ MA V GB MA	TANZ FA V GB FA	TANZ MA V TANZ FA	GB MA V GB FA
Ear Protr. Index	0.857 ±0.037	0.860 ±0.041	0.807 ±0.037	0.826 ±0.033	1%	1%	-	1%
Mouth Index	2.283 ±0.331	2.244 ±0.361	3.458 ±0.947	3.419 ±1.008	1%	1%	-	-
Lip Index	0.974 ±0.176	0.932 ±0.180	0.745 ±0.372	0.694 ±0.225	1%	1%	-	-
Eye Fiss. Index	2.951 ±0.408	2.956 ±0.437	3.409 ±0.680	3.495 ±0.665	1%	1%	-	-
Occular Index	2.792 ±0.309	2.738 ±0.280	2.989 ±0.360	3.006 ±0.293	1%	1%	-	-
Mouth Wdth. Index	2.189 ±0.193	2.307 ±0.258	2.547 ±0.262	2.570 ±0.242	1%	1%	1%	-
Nasal Brth. Index	2.890 ±0.226	3.008 ±0.236	3.624 ±0.283	3.682 ±0.309	1%	1%	1%	-
Inter-Occ. Wth.Index	3.868 ±0.427	3.774 ±0.365	4.432 ±0.545	4.390 ±0.465	1%	1%	-	-
Bioccular Wth. Index	1.387 ±0.065	1.381 ±0.073	1.485 ±0.087	1.461 ±0.069	1%	1%	-	-
Mouth-Nose Wth. Index	1.323 ±0.129	1.306 ±0.145	1.435 ±0.164	1.443 ±0.138	1%	1%	-	-
Biocc-Mth. Wth. Index	1.581 ±0.144	1.669 ±0.178	1.717 ±0.170	1.760 ±0.157	1%	1%	1%	-
Inter Occ-Nas.Wth.Ind	0.755 ±0.096	0.804 ±0.097	0.828 ±0.105	0.847 ±0.106	1%	5%	1%	-
Upper Face-Frhd.Ht.Ind	1.261 ±0.248	1.250 ±0.248	1.202 ±0.223	1.215 ±0.240	1%	1%	-	-
Upper-Lower Fce.Ht.Ind	0.973 ±0.113	0.984 ±0.096	1.005 ±0.110	1.059 ±0.113	1%	1%	-	1%
Lower Face-Frhd.Ht.Ind	1.298 ±0.228	1.271 ±0.215	1.196 ±0.198	1.152 ±0.201	1%	1%	-	-
Lower Face Prop.Index	3.093 ±0.356	3.094 ±0.365	3.251 ±0.394	3.159 ±0.364	1%	-	-	-
Nasal Ht. Prom.Index	1.812 ±0.281	1.950 ±0.270	1.642 ±0.218	1.721 ±0.214	1%	1%	1%	1%
Nasal Prom Brid.Index	2.302 ±1.051	2.203 ±0.923	2.106 ±1.124	1.979 ±0.542	1%	-	-	-
Whole Upper LipVert.Ind	1.998 ±0.323	1.966 ±0.307	2.455 ±0.405	2.467 ±0.458	1%	1%	-	-
Lower Fac. Ht.Vert.Ind	1.571 ±0.205	1.592 ±0.198	1.338 ±0.140	1.306 ±0.177	1%	1%	-	-

Table 6.3 Indices computed using one view only - Tanzania V G. Britain (continued)

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN - WHITNEY U TEST			
	TANZ MA n= 274	TANZ FA n= 84	GB MA n= 99	GB FA n= 70	TANZ MA V GB MA	TANZ FA V GB FA	TANZ MA V TANZ FA	GB MA V GB FA
Nasal Col. Lgth. Index	6.595 ±2.356	6.196 ±1.566	5.855 ±1.750	5.851 ±1.443	1%	-	-	-
Lat. Prop. Index I	1.650 ±0.106	1.647 ±0.073	1.645 ±0.113	1.590 ±0.104	-	1%	-	1%.
Lat. Prop. Index II	1.394 ±0.115	1.377 ±0.085	1.526 ±0.122	1.475 ±0.128	1%	1%	-	1%
Lat. Prop. Index III	1.188 ±0.092	1.199 ±0.075	1.081 ±0.075	1.082 ±0.077	1%	1%	-	-
Nasal Prom Lat. Index	5.528 ±0.730	6.050 ±0.755	4.180 ±0.409	4.335 ±0.476	1%	1%	1%	-
Nasal Brid Lat. Index	12.744 ±6.270	13.206 ±5.436	8.813 ±4.850	8.628 ±2.772	1%	1%	-	-

British female adults. Also, two measurements are significantly larger (significant at 5 percent level) for the Tanzanian female adults in comparison with the British female adults.

These results suggest that the Tanzanian face, and parts of it is significantly larger on average than the British adult face. There are, however, four measurements which are highly significantly larger for British male and female adults than for their Tanzanian counterparts. All of these measurements are concerned with the nose and are discussed in Section 6.2 (d).

The Bizygomatic Diameter, which is a measure of the width of the face, Vertical Height of Lower Face, Height of Face and Height of Upper Face, which are all measures of facial height, and Orbit - Auricle Distance and Auricle - Chin Distance which are measures of the lateral dimensions of the face, are all significantly larger (at 1 percent level) in absolute terms in the Tanzanian adults than in the British adults.

The General Facial Size Factor Index, which is computed using measurements from both frontal and profile views, gives a clear indica--tion of relative facial size. It is highly significantly greater for the Tanzanian adults than for the British adults (in the case of both males and females) as can be seen by consulting Table 6.4.

Table 6.4 Indices computed using both views (Tanzanian V Great Britain)

VARIABLES	MEANS and STANDARD DEVIATIONS				LEVELS of SIGNIFICANCE from MANN-WHITNEY U TEST			
	Tanz MA n = 190	Tanz FA n = 60	GB MA n = 99	GB FA n = 70	Tanz MA V GB MA	Tanz FA V GB FA	Tanz MA V TanzFA	GB MA V GB FA
General Facial Size Fac	5.405 ±0.547	4.853 ±0.294	4.935 ±0.198	4.581 ±0.234	1%	1%	1%	1%
Nasal Brid Ind	2.587 ±0.125	2.588 ±0.906	3.554 ±0.972	3.429 ±0.907	1%	1%	-	-
Nas Prom Index	5.267 ±0.700	4.784 ±0.633	6.678 ±0.679	6.351 ±0.660	1%	1%	1%	1%
Nasal Index	0.929 ±0.125	0.931 ±0.132	1.327 ±0.168	1.321 ±0.189	1%	1%	-	-

6.2(b) Forehead

From Table 6.2 it can be seen that there is no significant difference in the Height of the Forehead of the female adults or male adults from Tanzania and Britain. There are, however, differences, which are highly significant, in the Frontal Recession Angle, which represents the slope of the forehead. The slope of the forehead is highly significantly less great in the British adults (i.e. the Frontal Recession Angle is greater) than in the Tanzanian adults.

There is no significant difference in the relationship of the forehead, or frontal area, with the vertical (i.e. protraction or retraction).

The two indices which involve the height of the forehead, Upper Face - Forehead Height Index and Lower Face - Forehead Height Index, both show differences which are significant at the 1 percent level between Tanzanian adults and British adults of both sexes . The Upper Face - Forehead Height Index is highly significantly greater for the Tanzanian adults than for the British adults. This shows that the Tanzanian foreheads are on average relatively smaller than the Height of the Upper Face (sci - sn) than the British foreheads. The second index, the Lower Face - Forehead Height Index is highly significantly greater in the British adults, both male and female, than in the Tanzanian adults. This suggests that the forehead of the British adults is significantly smaller relative to the height of the lower face than is the case in the Tanzanian adults of both sexes (see Table 6.3).

6.2(c) Eyes

The Inter-Occular Distance, Bioccular Diameter, Right and Left Eye Fissure Heights, and Left and Right Eye Fissure Widths are all significantly larger (at 1 percent level) in the Tanzanian adults of both sexes than in the British adults (see Table 6.2). This is not surprising since these are absolute measurements and as already stated the Tanzanian adult face is in absolute terms significantly larger than the British adult face. The Interoccular Width Index and Bioccular Width Index show the opposite trends, however (see Table 6.3). Both those indices are highly significantly larger in the British adults of both sexes than in their Tanzanian counterparts. Both these indices are computed by comparing the first measurement, Interoccular Width or Bio-ccular Width, with the Bizygomatic Diameter. Since both the indices are larger for the British adults this means that the Interoccular Dis-tance (distance between inner corners of the eyes) and Bioccular Dis-tance (distance between outer corners of the eyes) are greater with respect to the overall width of the face in the British adults than the Tanzanian adults. The British eyes are thus set further apart than the Tanzanians.

The Occular Index is again highly significantly greater in British male and female adults than in Tanzanian male and female adults (see Table 6.3). The Occular Index is computed by dividing the Bioccular Diameter by the Inter-Occular Distance. This result means that the eyes of the British adults are wider relative to the width of the face in the British than in the Tanzanians.

The Eye Fissure Index, which is the mean Eye Fissure Width divided by the mean Eye Fissure Height, is highly significantly greater in the British male and female adults than in their Tanzanian counter-parts (see Table 6.3). This means that the eyes of the British adults are relatively speaking longer and narrower while the eyes of the Tanzanian adults are shorter and wider relative to the British (see Figure 6.1).

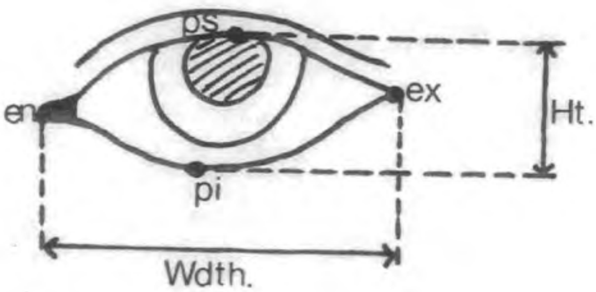
6.2(d) Ears

There are only two variables concerned with the ears. These are the Biaural Breadth and the Ear Protrusion Index. As shown in Table 6.2 there is no significant difference between the Biaural Breadths of the male or female adults of Tanzania and Britain.

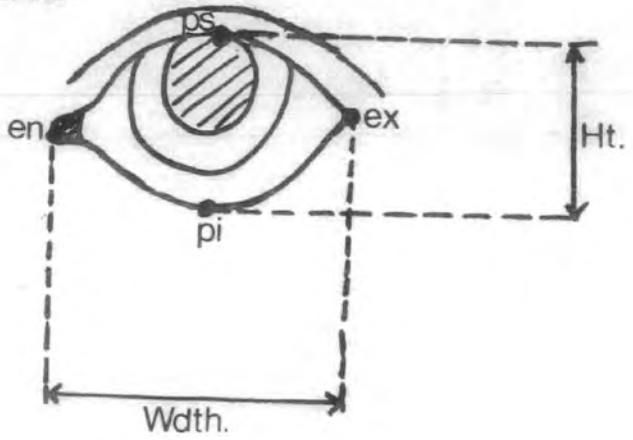
The Ear Protrusion Index, which is the Bizygomatic Diameter divided by Biaural Breadth, is highly significantly larger in the Tanzanian adults, both male and female, than in the British. This means that on average the British adults' ears protrude from the head more than the Tanzanian adults' ears.

Figure 6.1 Relative Shapes of eyes as determined by Eye Fissure Index and Occular Index

(a) British



(b) Tanzanian



6.2(e) Nose

From Table 6.2 the Tanzanian male and female adults have a highly significantly larger Nasal Breadth than the British male and female adults. On the other hand the British male and female adults

FIG. 6·2 - NASAL WING / SEPTUM RELATIONSHIP.

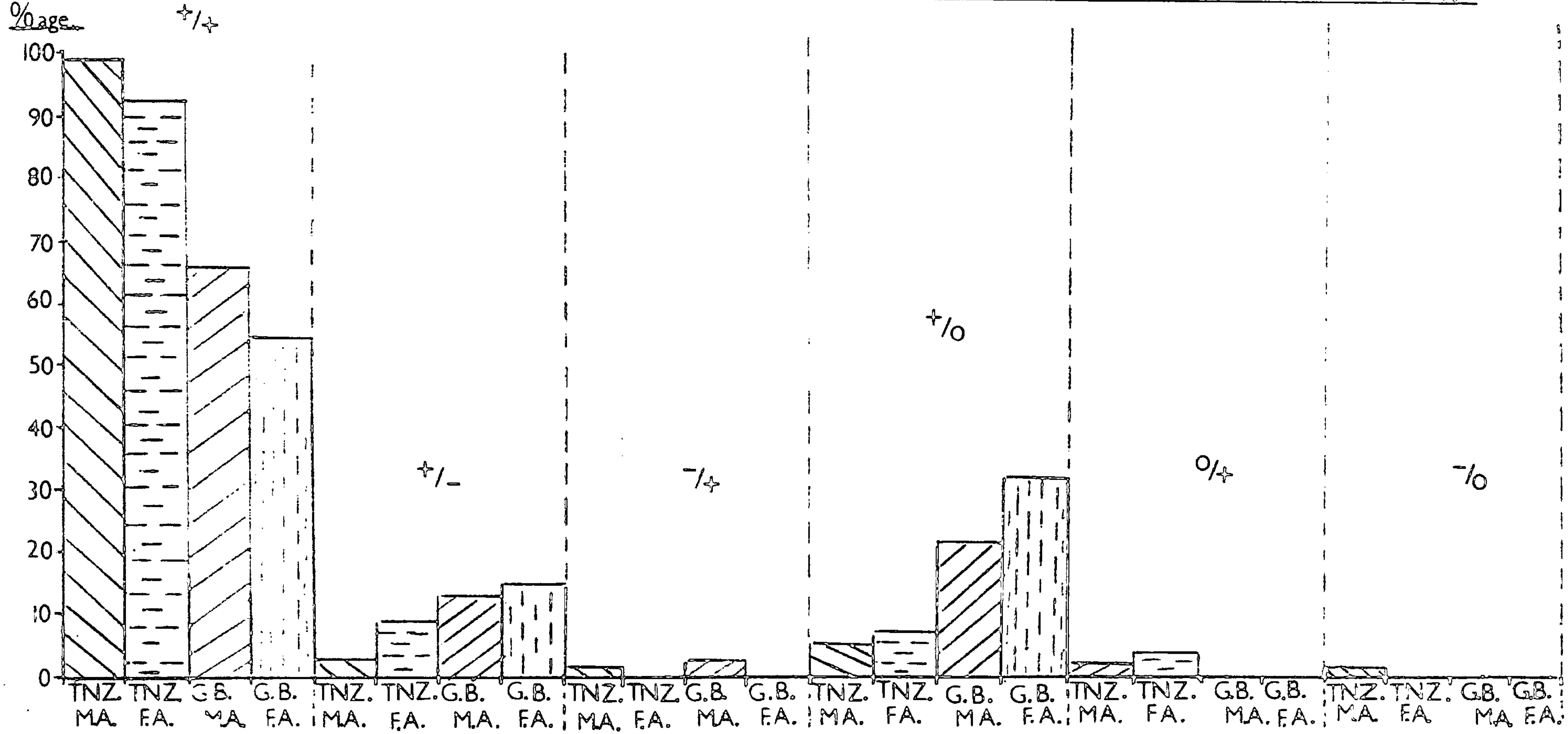


Table 6.5 Angles - Tanzania v Great Britain

VARIABLES	MEANS AND STANDARD DEVIATIONS			
	TANZ MA n= 274	TANZ FA n= 82	GB. MA n= 99	GB. FA n= 70
Nasal Angle	58.007 ± 5.707	59.439 ± 5.021	62.374 ± 4.304	62.471 ± 4.293
Nasal Base Angle	10.124 ± 5.354	8.415 ± 4.450	3.475 ± 4.141	3.386 ± 3.774
Upper Lip Angle	28.533 ± 9.113	28.488 ± 9.808	2.051 ± 10.799	- 2.457 ± 9.111
Chin Angle	- 10.000 ± 5.473	- 8.488 ± 5.080	- 11.133 ± 5.177	- 11.057 ± 5.286
Frontal Rec. Angle	73.248 ± 5.825	74.902 ± 6.101	76.704 ± 6.215	79.881 ± 5.095

Table 6.5 Angles - Tanzania v Great Britain (continued)

VARIABLES	LEVELS OF SIGNIFICANCE FROM MANN - - WHITNEY U TEST			
	TANZ.MA v GB. MA	TANZ.FA v GB. FA	TANZ.MA v TANZ. FA	GB. MA v GB. FA
Nasal Angle	1%	1%	5%	-
Nasal Base Angle	1%	1%	1%	-
Upper Lip Angle	1%	1%	-	1%
Chin Angle	5%	1%	5%	-
Frontal Rec. Angle	1%	1%	5%	1%

Table 6.6 Relationships - Tanzania V Great Britain

VARIABLES	PERCENTAGE FREQUENCIES				SIGNIFICANCE LEVEL FROM MANN - WHITNEY U TEST			
	TANZ MA n= 274	TANZ FA n= 83	GB MA n= 99	GB FA n= 70	TANZ MA v GB MA	TANZ FA v GB FA	TANZ MA v TANZ FA	GB MA v GB FA
Nasal Wing Septum Rel					1%	1%	-	-
+/+	88.3	81.9	66.7	55.7				
+/-	2.9	9.6	12.1	12.9				
-/+	0.7	0.0	1.0	0.0				
+/0	5.8	6.0	20.2	31.4				
0/+	1.8	2.4	0.0	0.0				
-/0	0.4	0.0	0.0	0.0				
Frontal					-	-	-	-
Protraction	59.9	68.7	52.5	61.4				
Retraction	40.1	30.1	43.4	21.4				
Vertical	0.0	1.2	4.0	17.1				
Nasal					1%	1%	-	-
Protraction	27.0	26.5	2.0	2.9				
Retraction	71.2	69.9	97.0	95.7				
Vertical	1.8	3.6	1.0	1.4				
Labial					1%	1%	-	-
Protraction	98.2	100.0	42.4	35.7				
Retraction	1.8	0.0	49.5	44.3				
Vertical	0.0	0.0	8.1	20.0				
Mandibular					1%	1%	-	-
Protraction	39.1	38.6	6.1	8.6				
Retraction	55.8	56.6	81.6	82.9				
Vertical	5.1	4.8	11.2	8.6				

have greater values which are highly significantly different from the Tanzanian adults for Nasal Height, Nasal Prominence and Nasal Bridge Distance. This means that on average the Tanzanians have broader noses but the British adult noses are longer and protruded more both at the root and the base. This is further corroberated by the values for the Nasal Angle the British adults have a larger Nasal Angle which is highly significantly different from that of the Tanzanian adult. This is shown in Table 6.5 as are the values for the Nasal Base Angle. In this case the Tanzanian adults, both male and female have a value which is larger than that for the British adults and the difference is highly significant. This means that the subnasale of the Tanzanian adults is further forward than the nasion, much more than in the adult British. This is supported by the results of the relationship of the nasal region to the vertical. The British adults have a greater value for the re--traction of the nasal alar than the Tanzanian who have a greater value for protraction. These differences are again found to be highly sign--ificant (see Table 6.6).

There is also a highly significant difference in the Nasal Wing/Septum Relationship, which is shown in Table 6.6 and in Figure 6.2. The Tanzanian adults are significantly higher in the $^{+}/+$ and $^{0}/+$ catag--ories whereas the British adults are significantly greater in the $^{+}/-$ and $^{+}/0$ catagories.

6.2(f) Mouth and Lips

The results for the absolute measurements of the lips and mouth show that Tanzanian male and female adults have greater mean values for each of the following variables; Mouth Width, Upper Lip Height, Lower Lip Height, Total Lip Height and Height of Whole Upper Lip. These are larger than the values for the British male and female adults and the differences are highly significant. This means that in absolute terms the mouth of the Tanzanian adult is larger in width and height than that of the British adult. Here again it must be pointed out that the faces of the Tanzanian adults are larger in absolute terms.

For the Mouth Width Index, which is a measure of how wide the mouth is in comparison with the total width of the face (Bizygomatic Diameter), the British male and female have highly significantly larger values than do the Tanzanian adults. This shows that the British adult mouth is wider than the Tanzanian in relation to the width of the face. The Bioccular - Mouth Width Index is highly significantly larger in the British adults than in the Tanzanian adults which reinforces the point already made about the British having wider mouths in relation to face width.

The Whole Upper Lip Vertical Index is significantly larger in the British than the Tanzanian. This is the distance from subnasale to stomion and goes along with the trend already mentioned, for the lower face to be relatively larger in the British adults than in the Tanzanians.

The Mouth Index, which is the Mouth Width divided by the Total Lip Height, is larger in the British adults than the Tanzanian adults and there is a highly significant difference. The Mouth Index may be larger for the British because either, as already stated, the Mouth Width is relatively larger in the British or, it may be that the Total Height of the lips is larger in the Tanzanians.

The Lip Index, which is the ratio of the Upper Lip Height divided by Lower Lip Height, is highly significantly larger for the Tanzanians than for the British. Also the Tanzanian values were closer to 1.0000 than the British values. This means that the lower lip of both Tanzanians and British was larger than the upper lip, but in the Tanza--nians the upper lip was comparatively larger and closer to being the same size as the lower lip, which would be the case if the values for the Lip Index was 1.0.

The Upper Lip Angle (see Table 6.5) is highly significantly larger in the Tanzanian adults than in the British. This means that the Tanzanian lips protrude more from the general vertical facial line than do the British lips. The Tanzanian lips are 26.482 and 30.945 degrees larger in terms of protrusion than the British counterparts, for male adult and female adult respectively.

The Relationship of the Labial Region to the Vertical shows that 98.2 percent and 100 percent of Tanzanian male adults and female adults respectively have lips which protract beyond the vertical. The British values for this are 42.4 and 35.7 percent for male and female adults respectively. On the other hand 49.5 percent male British adults and 44.3 percent female British adults have lips which are re--tracted compared to only 1.8 percent Tanzanian male adults and 0 per--cent for the Tanzanian female adults. Of the British female adults 20 percent have lips on the vertical compared with 8.1 percent British male adults and 0 percent for both male and female adult Tanzanians. All of these results are found to be highly significantly different (see Table 6.6).

6.2(g) Chin

The Chin Angle (see Table 6.5) shows the Tanzanian male adults to have a significantly greater (at 5 percent level) value than the British male adults. Simarly the Tanzanian female adults have a highly significantly larger angle (at 1 percent level) than the British female adults. This means that the chins of the Tanzanian adults pro--trude more on average than do the British chins. This fact is support--ed by the results of the protraction or retraction of the mandibular area in relation to the vertical. The greater amount of protraction is in the Tanzanian adults (both male and female) and more retraction is shown by male and female adult British. These differences are highly significant (ie. significant at 1 percent level).

The Lower Facial Height Vertical Index, which is computed by dividing the Vertical Height of the Lower Face (sn - gn) by the Nasal Height (n - sn), was found to be relatively larger in both male and female Tanzanian adults than in the male and female British adults. The differences shown are highly significant. This suggests that the Tanzanian lower facial height is greater than the British in relation to the vertical heights of the face.

The Lower Face Proportion Index, which is the Vertical Height of the Lower Face divided by the Height of the Whole Upper Lip (sn - sto), was found to be highly significantly larger in the Tanzanian male adults than in the British male adults but there was no significant difference between the Tanzanian and British female adults.

6.2(h) Lateral Proportions

The three indices which compare the lateral measurements of the face are the Lateral Proportion Indices I, II and III. Index I is computed by dividing the Auricle - Chin distance by the Orbit - Auricle distance. There was no significant difference in this index between the male adults of Britain and Tanzania but the female adults showed a highly significant difference. The value of Index I was greater for the female adult Tanzanians than for the corresponding British. The other two indices showed highly significant differences between Tanzanian and British male and female adults. Index II which is computed by divid--ing the Height of Face (n - gn) by the Orbit - Auricle Distance was significantly greater in the British male and female adults than in the Tanzanian counterparts (see Table 6.3). Index III, however, the Tanza--nian male and female adults had significantly larger values for this than the British. Index III being the Auricle - Chin Distance divided by the Height of the Face. These differences are significant at the 1 percent level, i.e., they are highly significant.

6.2(i) Chi - Square Test

To determine whether or not the variables where highly

Table 6.7 Standardized Discriminant Function Coefficients

Populations:- GB MA
GB FA
TANZ MA
TANZ FA

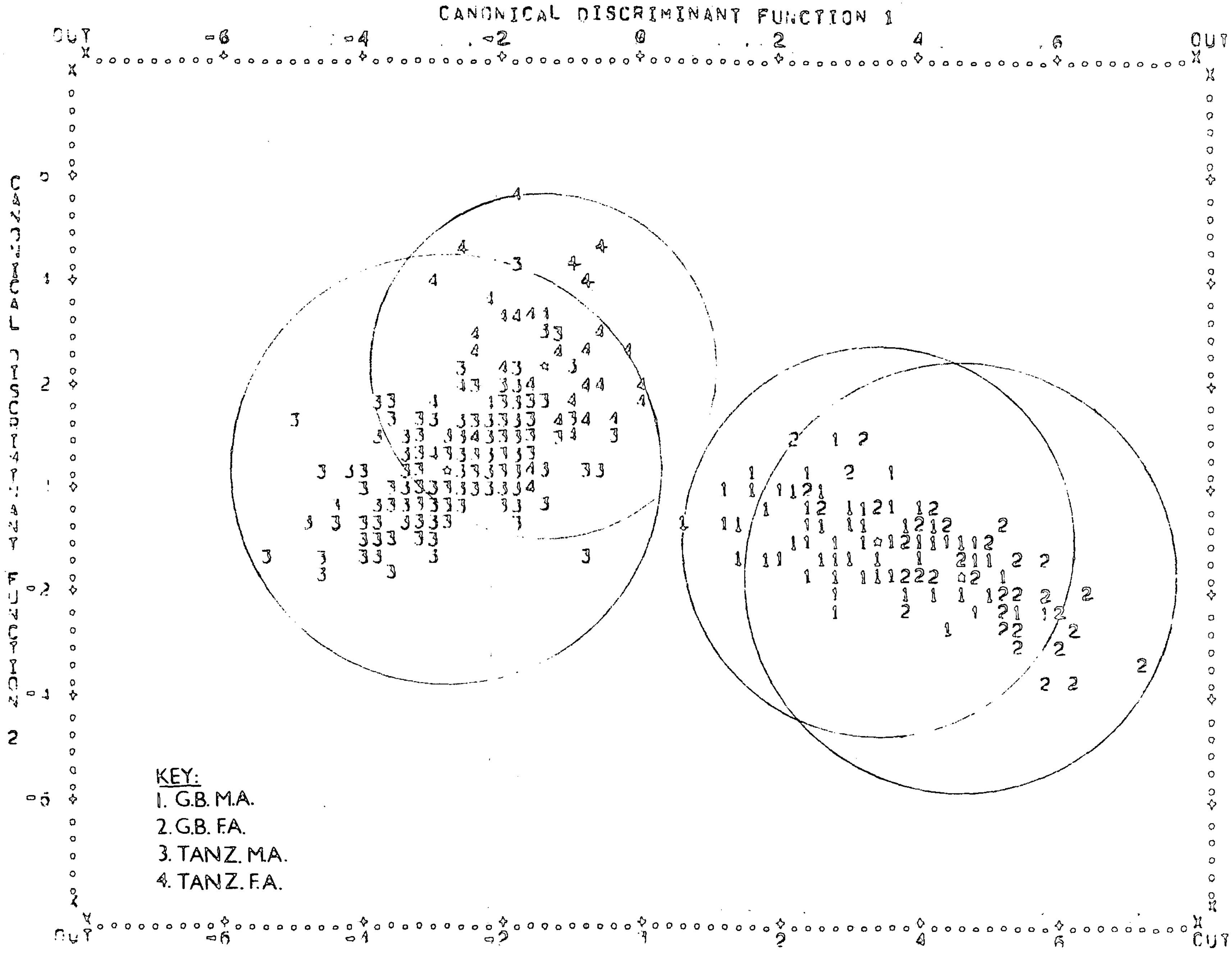
VARIABLES	COEFFICIENTS
FUNCTION 1	
Nasal Prominence Index	1.65997
Chin Angle	0.33608
Upper Lip Angle	-0.30931
Eye Fissure Index	0.29154
Bioccular Width Index	0.26985
Lower Face - Forehead Height Index	-0.18933
Labial Protraction/Retraction	0.17673
FUNCTION 2	
General Facial Size Factor	-7.97679
Height of Face	5.92442
Mouth Width	-1.87967
Lateral Proportion Index III	1.72318
Mouth - Nose Width Index	1.71420
Nasal Bridge Lateral Index	-1.14993
Nasal Prominence Lateral Index	1.04140
Nasal Prominence - Bridge Index	1.01342
Lower Lip Height	0.89860
Lateral Proportion Index II	-0.86343
Occular Index	-0.53124
Inter - Occular Distance	-0.42988
Lip Index	0.40019
Left Eye Fissure Height	0.36394
Columella Length	-0.33886
Columella Length Vertical Index	-0.30792
Mandibular Protraction/Retraction	0.18211
FUNCTION 3	
Biaural Breadth	7.47075
Bizygomatic Diameter	-5.81071
Ear Protrusion Index	4.36641
Nasal Prominence	2.64445
Nasal Breadth Index	-1.71738
Nasal Breadth	-1.47271
Total Lip Height	-1.02755
Mouth Index	-0.48323
Height of Upper Face	-0.31238
Left Eye Fissure Width	0.19811
Nasal Wing/Septum Relationship	-0.18477
Lower Face Proportion Index	0.17893

significant differences are shown are just minor differences or a significant deviation from the expected number the Chi-Square Test is applied. For this case the x value equals 8603. On looking this number up in the Chi-Square tables (see Appendix 8) the value is larger than any values listed for just two classes. This means that there is less than one chance in one hundred that these results could have been produced by chance alone.

6.2(j) Discriminant Function Analysis

The variation which most contribute to discriminating between the four groups, Tanzanian MA, Tanzanian FA, Great Britain MA, and Great Britain FA are shown in Table 6.7. The variables in Function 1 account for 90.64 percent of variation between the groups, Function 2 accounts for 5.55 percent variation and Function 3 for 3.81 percent variation (see Appendix 4).

These functions 1 and 2 were then used to plot Scatterplots of the four groups to show their relationship to one another as can be seen in Figure 6.3(a). Figures 6.3(b - e) shows each group separately. From Figure 6.3(a) it can be seen that the canonical discriminant func--tions 1 and 2 separates the British sample (Groups 1 and 2) quite well from the Tanzanian sample (Groups 3 and 4). Furthermore the males and females can also be separated into overlapping clusters the centroids of which are well removed (see Section 6.5 for further details). The differences between the groups can be gauged by looking at the group centroids and their distances apart. Table 6.8 shows the F Statistics and significances between pairs of groups . It can be seen from table 6.8 that the F Statistics between G.B. MA and G.B. FA and also between TANZ MA and TANZ FA are smaller showing the groups are close together. The F Statistics between the two British and two Tanzanian groups are much larger showing the inter-group differences are much greater. The significant differences between all of the pairs of groups is 0 which



☆ INDICATES A GROUP CENTROID

Figure 6.3(c) Scatterplot for G.B. M.A. & F.A. and Tanz. M.A. & F.A.

Figure 6.3(b) — Group 1 = G.B. M.A.

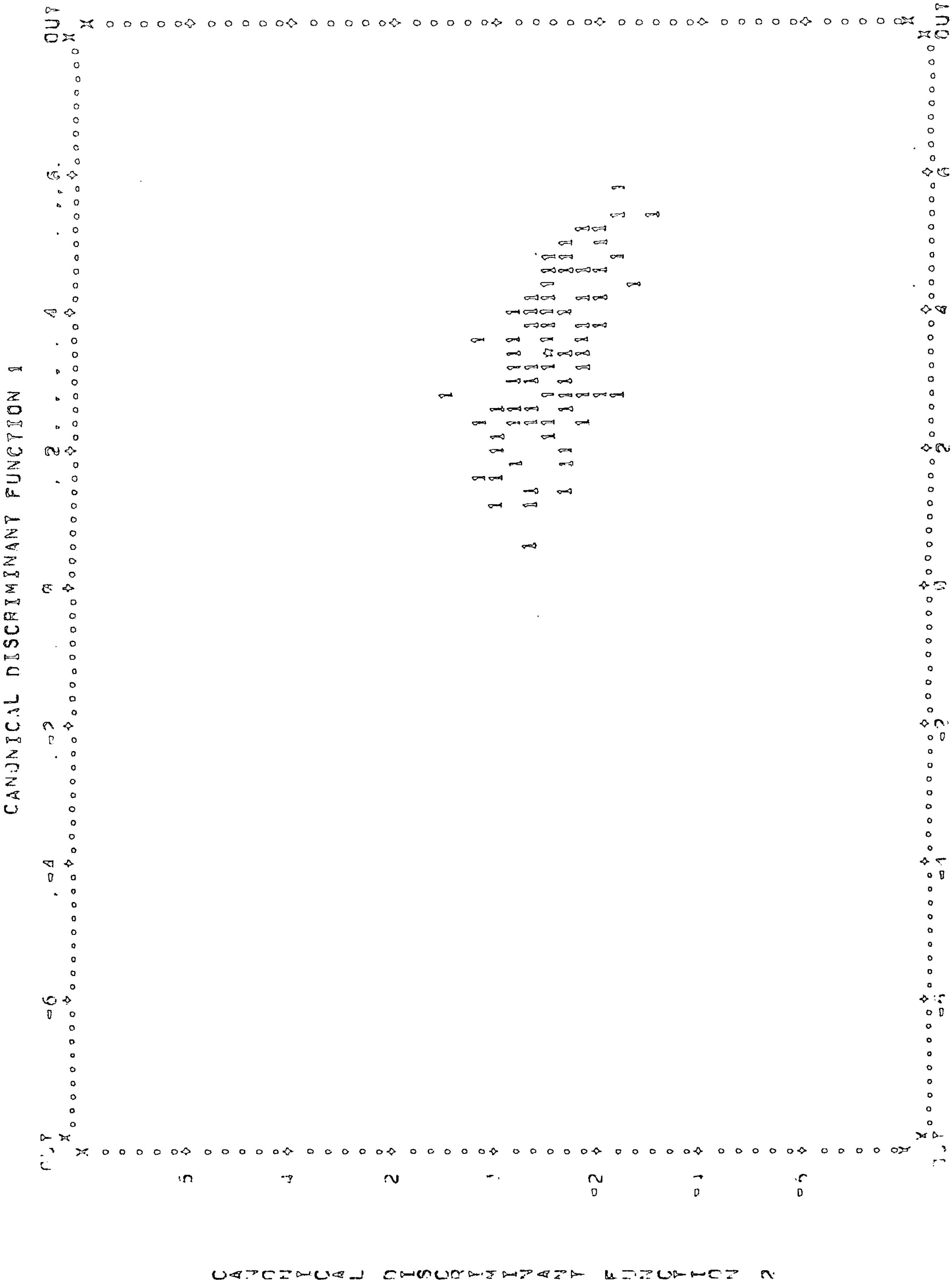
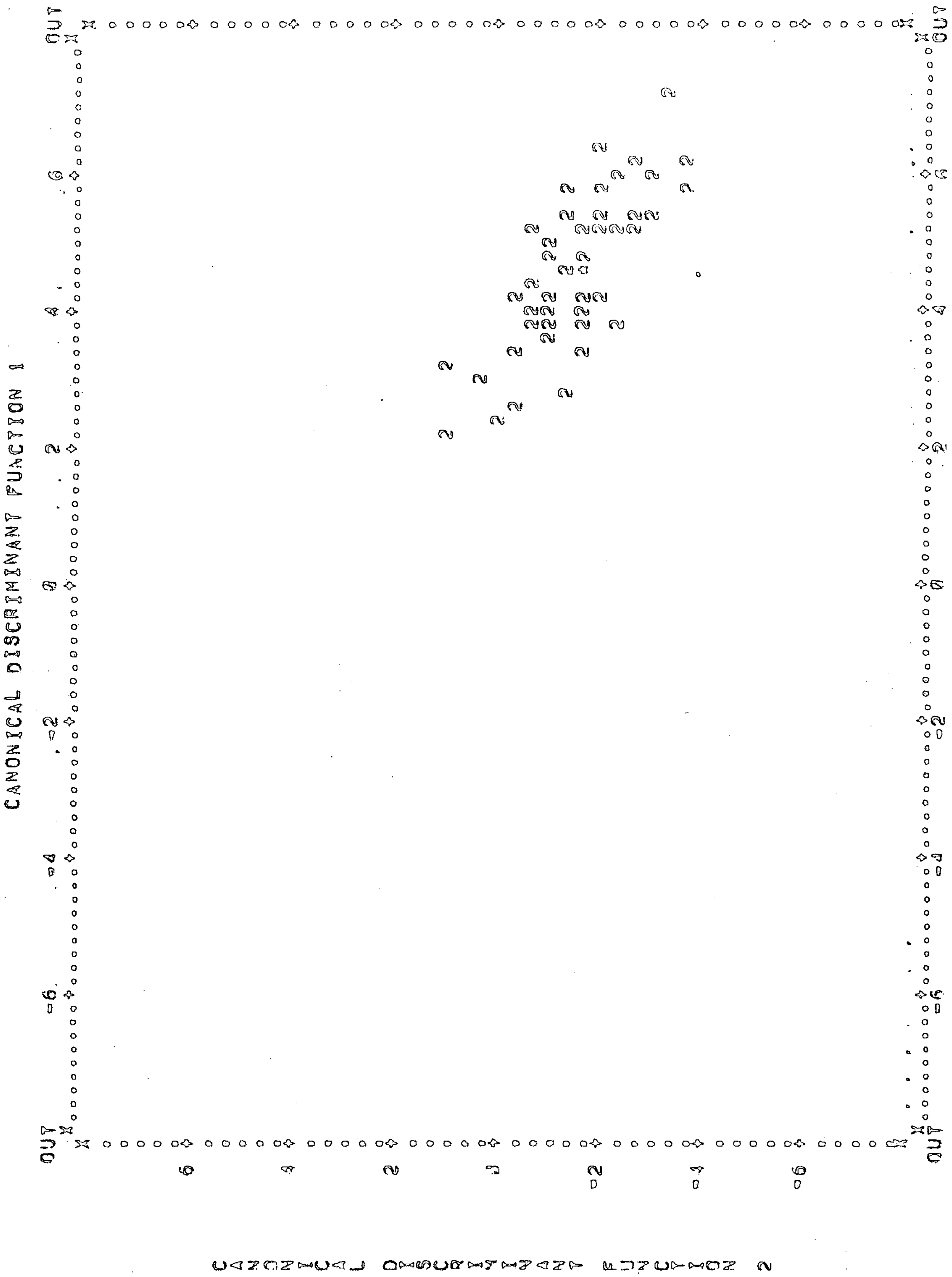


Figure 6.3 (c) – Group 2 = G.D. P.A.



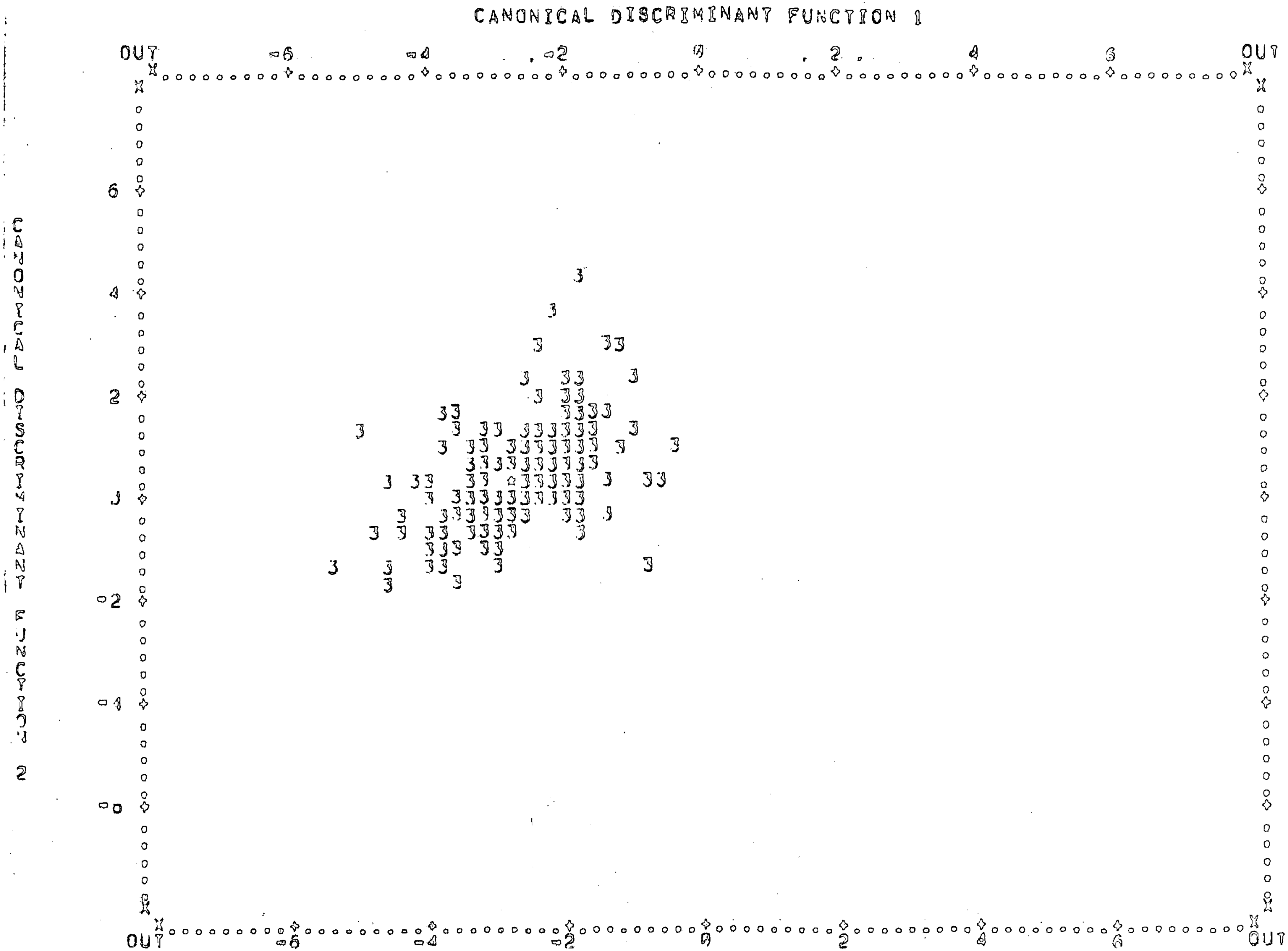
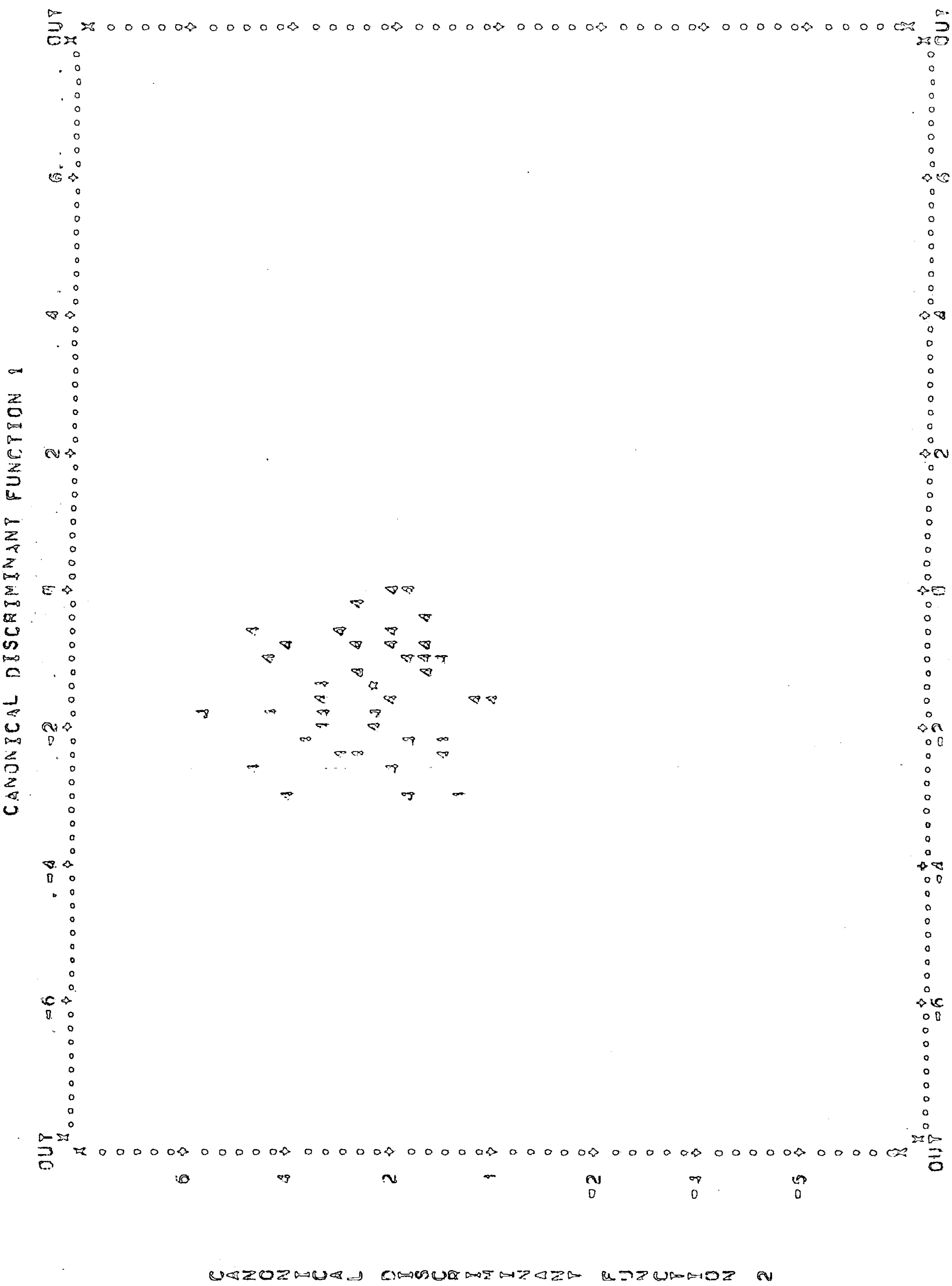


Figure 6.3(d) — Group 3 = Inc. M.A.

Figure 6.3(c) -- Group 4 = Tanz. F.A.



means that there is a highly significant difference between all of the different combinations .

Table 6.8 F Statistics and significances between pairs of groups

GROUP	1 GB MA	2 GB FA	3 TANZ MA
2 GB FA	5.6129 0.0000		
3 TANZ MA	70.611 0.0	53.107 0.0	
4 TANZ FA	33.328 0.0	29.844 0.0	5.2416 0.0000

Table 6.9 shows the results of taking all of the individuals from their particular sample groups and reclassifying them by using the selected variables. As can be seen 86.44% of the grouped cases are correctly classified, and of those incorrectly classified they are within their own country. Thus showing that the separation between Tanzania and Great Britain is 100% correctly classified.

Table 6.9 Classification Results

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2	3	4
GROUP 1	93	82 88.2%	11 11.8%	0 0.0%	0 0.0%
GROUP 2	48	7 14.6%	41 85.4%	0 0.0%	0 0.0%
GROUP 3	170	0 0.0%	0 0.0%	146 85.9%	24 14.1%
GROUP 4	43	0 0.0%	0 0.0%	6 14.0%	37 86.0%

Percentage of "Grouped" cases correctly classified = 86.44%

GROUP 1 = GB MA

GROUP 2 = GB FA

GROUP 3 = TANZ MA

GROUP 4 = TANZ FA

From Table 6.7 the seven variables account for over 90% of the variation. These seven, the Nasal Prominence Index, Chin Angle, Upper Lip Angle, Eye Fissure Index, Bioccular Width Index, Lower Face - - Forehead Height Index and Labial Protraction or Retraction are the best at discriminating between the four populations Tanzanian male adults and female adults and British male adults and female adults.

6.3 The Tribes of Tanzania compared with each other

6.3(a) The head and size of the face

There were five tribes from which samples were taken for this study, the Hehe, Nyakyusa, Tutsi, Sukuma and Kinga. In this sec- -tion the tribes will be compared with each other using male adults only. The photographs of the Kinga were, unfortunately, unscaled and, therefore, they cannot be included in the absolute measurement analysis and the indices taken from both views. They are used for the other indices calculated using single views only and for the statistics for angles and relationships.

From Table 6.10 it can be seen that there are highly signifi- -cant differences in the Bizygomatic Diameter between all of the four tribes, Hehe, Tutsi, Nyakyusa and Sukuma compared with one another. On average the Nyakyusa have the largest Bizygomatic Diameter followed in order by the Sukuma, then the Hehe and finally the Tutsi have the small- -est mean Bizygomatic Diameter. Table 6.11 shows the results of compar- -ing each tribe separately with the rest. All except the Sukuma have mean values which are highly significantly different from the rest of the Tanzanian male adults.

The height of the face is highly significant in all of the comparisons between the four tribes apart from the Tutsi compared with the Hehe where no significant difference is shown. The greatest value is shown by the Nyakyusa once again followed in order by Sukuma, Hehe and Tutsi as was the case for the Bizygomatic Diameter. When each

Table 6.10 Mann - Whitney U Test Results - Tribes of Tanzania

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST					
	HEHE MA n= 66	TUTS MA n= 10	SUKU MA n= 49	NYAK MA n= 64	HEHE v TUTS	HEHE v SUKU	HEHE v NYAK	TUTS v SUKU	TUTS v NYAK	SUKU v NYAK
Bizygo. Diameter	149.894 ± 8.889	135.500 ± 8.606	159.388 ± 9.092	168.062 ± 9.962	1%	1%	1%	1%	1%	1%
Biaural Breadth	176.000 ±11.003	161.202 ± 7.208	188.551 ±11.074	192.437 ±10.607	1%	1%	1%	1%	1%	-
Nasal Breadth	52.409 ± 4.064	42.600 ± 2.663	54.898 ± 3.944	58.766 ± 4.086	1%	1%	1%	1%	1%	1%
Int.-Occ. Distance	39.924 ± 3.860	35.600 ± 4.993	41.857 ± 5.087	43.281 ± 5.230	1%	5%	1%	1%	1%	-
Bioccular Diameter	108.803 ± 6.576	97.800 ± 5.181	114.163 ± 5.814	121.781 ± 7.879	1%	1%	1%	1%	1%	1%
Mouth Width	70.400 ± 6.921	-	75.417 ± 6.671	78.413 ± 6.308	x	1%	1%	x	x	5%
Upper Lip Height	14.762 ± 2.312	15.857 ± 2.968	16.646 ± 2.964	17.127 ± 2.679	-	1%	1%	-	-	-
Lower Lip Height	15.651 ± 2.695	15.857 ± 1.676	17.708 ± 2.601	17.810 ± 2.435	-	1%	1%	-	5%	-
Total Lip Height	30.349 ± 4.178	31.714 ± 3.684	34.479 ± 4.626	34.984 ± 4.050	-	1%	1%	-	-	-
Right Eye Fiss. Ht.	10.585 ± 1.580	11.100 ± 1.370	13.102 ± 2.248	13.594 ± 1.620	-	1%	1%	1%	1%	-
Left Eye Fiss. Ht.	10.446 ± 1.436	10.900 ± 1.917	13.327 ± 2.410	13.562 ± 1.754	-	1%	1%	1%	1%	-
Right Eye Fiss.Wth.	33.015 ± 3.208	31.700 ± 1.636	34.714 ± 4.257	37.641 ± 3.525	-	-	1%	5%	1%	1%
Left Eye Fiss.Wth.	33.333 ± 3.279	31.000 ± 1.886	35.347 ± 4.342	38.047 ± 3.574	5%	5%	1%	1%	1%	1%
Nasal Prom.	25.227 ± 4.895	25.182 ± 3.188	30.354 ± 4.592	31.000 ± 4.027	-	1%	1%	1%	1%	-
Nasal Brid.Dist.	11.538 ± 4.793	14.909 ± 3.961	15.146 ± 4.467	15.631 ± 4.702	-	1%	1%	-	-	-
Nasal Height	45.742 ± 5.650	42.909 ± 5.029	52.271 ± 7.199	53.354 ± 6.382	-	1%	1%	1%	1%	5%
Ht.ofWhole Upp. Lip	23.530 ± 3.212	23.091 ± 2.468	26.083 ± 4.252	26.892 ± 3.231	-	1%	1%	5%	1%	-
Vert.Ht of Low.Face	73.242 ± 8.851	70.364 ± 4.717	82.687 ± 9.680	85.354 ± 7.201	-	1%	1%	1%	1%	-
Height of Forehead	52.561 ± 9.715	59.364 ± 7.540	67.375 ± 7.609	65.892 ± 8.723	5%	1%	1%	1%	5%	-
Height of Upp. Face	71.591 ± 7.054	66.000 ± 3.873	81.570 ±10.340	82.662 ± 8.510	1%	1%	1%	1%	1%	-
Orb.-Aur. Distance	87.354 ± 7.134	83.818 ± 4.215	98.042 ± 9.913	100.969 ± 8.111	-	1%	1%	1%	1%	-

Table 6.10 Mann - Whitney U Test Results - Tribes of Tanzania (continued)

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST					
	HEHE MA n= 66	TUTS MA n= 10	SUKU MA n= 49	NYAK MA n= 64	HEHE v TUTS	HEHE v SUKU	HEHE v NYAK	TUTS v SUKU	TUTS v NYAK	SUKU v NYAK
Auricle Chin-Dist	142.348 ±12.042	138.818 ± 6.882	165.104 ±16.267	171.062 ±13.265	-	1%	1%	1%	1%	-
Height of Face	118.682 ±10.678	113.727 ± 7.417	135.708 ±14.235	142.708 ±11.208	-	1%	1%	1%	1%	1%
Columella Length	7.788 ± 2.509	7.000 ± 2.408	9.333 ± 2.999	9.523 ± 2.969	-	1%	1%	5%	1%	-

Table 6.11

VARIABLES	HEHE MA v REST. TANZ MA		TUTSI MA v REST. TANZ MA		SUKUMA MA v REST. TANZ MA		NYAKYUSA MA v REST. TANZ MA	
	Sig.at 5%lev.	Sig.at 1%lev.	Sig.at 5%lev.	Sig.at 1%lev.	Sig.at 5%lev.	Sig.at 1%lev.	Sig.at 5%lev.	Sig.at 1%lev.
Bizygomatic Diameter		✓		✓				✓
Biaural Breadth		✓		✓		✓		✓
Nasal Breadth		✓		✓				✓
Inter-Occular Distance		✓		✓				✓
Bioccular Diameter		✓		✓				✓
Mouth Width		✓	✓					✓
Upper Lip Height		✓						✓
Lower Lip Height		✓			✓			✓
Total Lip Height		✓			✓			✓
Right Eye Fissure Height		✓	✓			✓		✓
Left Eye Fissure Height		✓	✓			✓		✓
Right Eye Fissure Width		✓		✓				✓
Left Eye Fissure Width		✓		✓				✓
Nasal Prominence		✓		✓		✓		✓
Nasal Bridge Distance		✓						✓
Nasal Height		✓		✓	✓			✓
Height of Whole Upper Lip		✓	✓					✓
Vertical Height of Lower Face		✓		✓		✓		✓
Height of Forehead		✓				✓		✓
Height of Upper Face		✓		✓		✓		✓
Orbit-Auricle Distance		✓		✓		✓		✓
Auricle-Chin Distance		✓		✓		✓		✓
Height of Face		✓		✓		✓		✓
Columella Length		✓	✓					✓

tribe is taken individually and compared with the rest, all of the tribes showed differences in Facial Height which are highly significant in comparison with the rest.

The Height of the Upper Face shows the same pattern with Nyakyusa being the largest followed by Sukuma, Hehe and the Tutsi. There are significant differences at the 1 % level shown when all of the tribes are compared with each other apart from the Nyakyusa compared with the Sukuma. When each tribe was taken separately and compared with the rest all comparison showed differences which were highly significant.

The two absolute measurement of the lateral dimensions of the face, the Orbit-Auricle Distance and Auricle-Chin Distance, both show the same results as previously. Nyakyusa having the largest value followed by Sukuma, then Hehe, and smallest was Tutsi. In the cases of both measurements when the tribes were compared with each other all showed highly significant differences apart from Hehe compared with Tutsi and Sukuma compared with Nyakyusa (i.e. the two largest values and the two smallest).

Finally the General Facial Size Factor Index which is the best indication of relative overall facial size is shown in Table 6.12(a). In this Sukuma has the largest value followed in order of size by Nyakyusa, Hehe and Tutsi. When the tribes are compared with each other differences are shown in all which are highly significant.

Table 6.12(a) Indices Computed using Both Views

VARIABLES	MEANS AND STANDARD DEVIATION				LEVELS OF SIGNIFICANCE FROM MANN - WHITNEY U TEST					
	HEHEMA n= 66	TUTSIMA n= 10	SUKU MA n= 49	NYA MA n= 64	HEHE v TUT	HEHE v SUKI	HEHE v NYAK	TUT v SUKU	TUT v NYAK	SUKI v NYAK
Gen. Facial Size Factor	4.980 ±0.348	4.698 ±0.213	5.581 ±0.459	5.827 ±0.367	1%	1%	1%	1%	1%	1%
Nasal Brid. Index	2.308 ±0.927	3.216 ±0.727	2.707 ±0.755	2.672 ±0.804	1%	5%	5%	-	5%	-
Nasal Prom. Index	5.077 ±0.815	5.358 ±0.607	5.437 ±0.672	5.316 ±0.572	-	5%	5%	-	-	-
Nasal Index	0.878 ±0.119	1.031 ±0.160	0.953 ±0.124	0.946 ±0.108	1%	1%	1%	-	-	-

Table 6.12(b) Indices using both views

VARIABLES	HEHE MA v REST TANZ.MA		TUTSI MA v REST TANZ.MA		SUKUMA MA v REST TANZ.MA		NYAKYUSA MA v REST TANZ.MA	
	Sig.At 5% lev	Sig.At 1% lev	Sig.At 5% lev	Sig.At 1% lev	Sig.At 5% lev	Sig.At 1% lev	Sig.At 5% lev	Sig.At 1% lev
Gen.Facial Size Factor		✓		✓		✓		✓
Nasal Bridge Index		✓	✓					
Nasal Prom. Index		✓						
Nasal Index		✓		✓				

Table 6.13 Angles

VARIABLES	MEANS AND STANDARD DEVIATIONS				
	HEHE MA n= 112	TUTSI MA n= 11	SUKUMA MA n= 48	NYAKYUSA MA n= 84	KINGA MA n= 19
Nasal Angle	59.089 ± 5.850	54.364 ± 5.579	55.750 ± 4.964	58.464 ± 5.826	57.421 ± 2.341
Nasal Base Angle	8.955 ± 5.579	11.182 ± 4.513	11.938 ± 4.265	10.262 ± 5.798	11.211 ± 3.119
Upper Lip Angle	27.205 ± 9.475	31.091 ± 10.173	28.333 ± 6.580	29.690 ± 9.594	30.263 ± 9.303
Chin Angle	- 9.527 ± 6.033	- 12.000 ± 5.215	- 9.208 ± 4.726	- 10.821 ± 5.078	- 10.000 ± 5.364
Frontal Rec. Angle	73.725 ± 5.510	71.182 ± 6.258	71.958 ± 5.982	73.810 ± 6.110	72.421 ± 5.419

Table 6.13 Angle (continued)

VARIABLES	LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST									
	HEHE v TUTSI	HEHE v SUKU	HEHE v NYAK	HEHE v KINGA	TUTSI v SUKU	TUTSI v NYAK	TUTSI v KINGA	SUKU v NYAK	SUKU v KINGA	KINGA v NYAK
Nasal Angle	5%	1%	-	-	-	-	-	5%	-	-
Nasal Base Ang.	-	1%	-	-	-	-	-	-	-	-
Upper Lip Angle	-	-	-	-	-	-	-	-	-	-
Chin Angle	-	-	-	-	-	-	-	-	-	-
Frontal Rec.Angle	-	-	-	-	-	-	-	-	-	-

Table 6.14 Angle and Relationships

VARIABLES	HEHE MA v REST TANZ.MA		TUTSI MA v REST TANZ.MA		SUKUMA MA v REST TANZ.MA		NYAKYUSA MA v REST TANZ.MA		KINGA MA v REST TANZ.MA	
	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev
Nasal Angle		✓				✓				
Nasal Base Angle		✓			✓					
Upper Lip Angle										
Chin Angle										
Frontal Rec.Angle										
Nasal Wing/ Septum Rel.		✓			✓					
Frontal Vert.Rel.	✓								✓	
Nasal Vert.Rel.										
Labial Vert.Rel.										
Mandibular Vert.Rel.										

It, therefore, appears that in absolute terms the Tutsi have the smallest faces followed by the Hehe. The Nyakyusa and Sukuma have the largest faces the Nyakyusa being the larger of the two in all single absolute measurement by the Sukuma being the larger in the General Facial Size Index a ratio computed using four single measurements, the two lateral measurements, Facial Height and Bizygomatic Diameter.

6.3(b) Forehead

From Table 6.10 it can be seen that the Sukuma have the largest foreheads in absolute terms (Height of Forehead) followed by Nyakyusa, Tutsi and Hehe in order of increasing Forehead Height. When the tribes are compared with each other using this variable highly significant differences are shown by Hehe v Sukuma, Hehe v Nyakyusa, and Tutsi v Sukuma. Significant differences (at 5% level) are shown by Hehe v Tutsi and Tutsi v Nyakyusa. There was no significant difference shown between Sukuma and Nyakyusa. When each tribe was compared separately with the rest of Tanzania all showed highly significant differences apart from the Tutsi which showed no significant difference.

From Tables 6.13 and 6.14 it can be seen that there are no significant differences in Frontal Recession Angles between any of the five tribes (Kinga are included here).

From Table 6.15 it is apparent that the only significant difference, and this is at the 1% level, is between the Hehe and Kinga for the relationship of the frontal region to the vertical. There are more retracted foreheads in the Hehe sample than the Kinga.

There are two other variables to be considered in this section and these are indices computed using the profile view only. They are the Upper Face-Forehead Height Index and the Lower Face-Forehead Height Index. The results of the statistical analysis of these indices are shown in Table 6.16. The Upper Face-Forehead Height Index shows significant variation only between the Hehe and Tutsi, and between the Hehe and

Table 6.15 Relationships

VARIABLES	PERCENTAGE FREQUENCIES HEH MA n= 112	TUT MA n= 11	SUK MA n= 48	NYK MA n= 84	KIN MA n= 19	LEVELS OF SIGNIFICANCE FROM MANN - WHITNEY U TEST HEH v TUT	HEH v SUK	HEH v NYK	HEH v KIN	TUT v SUK	TUT v NYK	TUT v KIN	SUK v NYK	SUK v KIN	KIN v NYK
Nasal Wing/ Septum Rel.						-	1%	-	5%	5%	-	-	-	-	-
+/+	81.3	81.8	97.9	90.5	100										
+/-	5.4	0.0	0.0	2.4	0.0										
-/+	1.8	0.0	0.0	0.0	0.0										
+/0	7.1	18.2	0.0	7.1	0.0										
0/+	3.6	0.0	2.1	0.0	0.0										
-/0	0.9	0.0	0.0	0.0	0.0										
Frontal						-	-	-	1%	-	-	-	-	-	-
Protraction	67.9	54.5	54.2	59.5	70.0										
Retraction	32.1	45.5	45.8	40.5	20.0										
Vertical	0.0	0.0	0.0	0.0	10.0										
Nasal						-	-	-	-	-	-	-	-	-	-
Protraction	28.6	9.1	25.0	28.6	2.5										
Retraction	70.5	90.0	75.0	67.9	95.0										
Vertical	0.9	0.0	0.0	3.6	5.3										
Labial						-	-	-	-	-	-	-	-	-	-
Protraction	96.4	100.0	100	98.8	100										
Retraction	3.6	0.0	0.0	1.2	0.0										
Vertical	0.0	0.0	0.0	0.0	0.0										
Mandibular						-	-	-	-	-	-	-	-	-	-
Protraction	40.2	18.2	43.8	38.1	36.8										
Retraction	50.0	81.8	56.3	59.5	57.9										
Vertical	9.8	0.0	0.0	2.4	5.3										

Sukuma. The second index, the Lower Face-Forehead Height Index shows highly significant difference only between the Hehe and Sukuma. In both cases the Hehe have the largest value suggesting their foreheads are smaller than Tutsi or Sukuma.

6.3(e) Eyes

From Table 6.10 the absolute measurements concerning the eyes can be extracted. The Inter-Occular Distance and the Bioccular Diameter show the same results as other height and width absolute measurements of the face with the values being greatest for the Nyakyusa followed, in descending order, by the Sukuma, Hehe and Tutsi. For the Eye Fissure Heights and Widths the order is slightly changed with the Nyakyusa again being the largest for each followed by the Sukuma, the Tutsi are, however, the next largest followed by the Hehe with the smallest values. For the Bioccular Diameter highly significant differences are shown between all of the groups and for all of the groups individually compared with the rest apart from the Sukuma. The Inter-Occular Distance shows highly significant differences for four of the comparisons, the Hehe compared with the Sukuma shows a significant difference (at 5% level) while the Sukuma compared with the Nyakyusa shows no significance. The comparisons of the tribes against the rest individually, are exactly the same as for the Bioccular Diameter.

The Eye Fissure Height measurements show significant differences (at 1% level) for Hehe v Sukuma, Hehe v Nyakyusa, Tutsi v Sukuma and Tutsi v Nyakyusa. Hehe compared with Tutsi and Sukuma compared with Nyakyusa show no significant differences. The Eye Fissure Width measure--ments show significant differences between all groups compared and for all groups apart from the Sukuma compared with the Rest of Tanzania.

There are no significant differences between the values for any of the groups for the Occular Index, Inter-Occular Width Index and Bioccular Width Index. The Eye Fissure Index is largest in the Hehe and

and highly significant differences are shown between the Hehe and Sukuma, Nyakyusa and Kinga. The Eye Fissure Index values show significant difference between the Hehe and Tutsi. The Sukuma and Nyakyusa also show a highly significant difference for the Eye Fissure Index.

6.3(d) Ears

The values for Biaural Breadth show Nyakyusa to have the largest breadth followed by Sukuma, Hehe and Tutsi in order of descending size (see Table 6.10). There are highly significant differences between all of the tribes apart from the comparison of Sukuma and Nyakyusa. From Table 6.11 it can be seen that when each tribe is compared with the rest of Tanzania there are highly significant differences in each case for Biaural Breadth.

From Table 6.16 it can be seen that there are highly significant differences in the Ear Protrusion Index when Hehe are compared with Nyakyusa, and Tutsi are compared with Nyakyusa. Nyakyusa have the largest Ear Protrusion Index. Tutsi and Kinga also show significant difference when compared for this index. Tutsi have the smallest value for this index and Kinga the second largest.

6.3(e) Nose

From Table 6.10 the results for the following absolute measurements concerned with the nose can be seen; Nasal Breadth, Nasal Prominence, Nasal Height, Columella Length and Nasal Bridge Distance. The first four of these absolute measurements follow the same trend. In all cases the Nyakyusa have the highest value followed by Sukuma, Hehe and then, with the smallest value, Tutsi. When comparisons are made between all of the tribes with one another and also individually with the rest of Tanzania highly significant differences result for the Nasal Breadth. For the Nasal Prominence highly significant differences are shown in all the comparisons except those Sukuma and Nyakyusa, and for Hehe and Tutsi. These are the two largest and two smallest values and

Table 6.16 Indices computed using one view only

VARIABLES	MEANS AND STANDARD DEVIATIONS				
	HEHE MA n= 112	TUTSI MA n= 11	SUKUMA MA n= 49	NYAK. MA n= 84	KINGA MA n= 19
Ear Protrusion Index	0.852 ± 0.035	0.828 ± 0.043	0.846 ± 0.041	0.871 ± 0.031	0.862 ± 0.036
Mouth Index	2.359 ± 0.326	-	2.218 ± 0.316	2.253 ± 0.333	2.174 ± 0.327
Lip Index	0.982 ± 0.177	-	0.951 ± 0.174	0.976 ± 0.182	0.965 ± 0.148
Eye Fissure Index	3.139 ± 0.367	2.885 ± 0.402	2.692 ± 0.364	2.888 ± 0.350	2.831 ± 0.516
Occular Index	2.772 ± 0.279	2.784 ± 0.307	2.756 ± 0.270	2.830 ± 0.337	2.837 ± 0.436
Mouth Width Index	2.203 ± 0.214	-	2.120 ± 0.160	2.189 ± 0.176	2.290 ± 0.176
Nasal Breadth Index	2.859 ± 0.214	3.141 ± 0.229	2.914 ± 0.214	2.893 ± 0.234	2.866 ± 0.224
Inter-Occular Width Index	3.816 ± 0.381	3.807 ± 0.504	3.846 ± 0.361	3.932 ± 0.457	3.977 ± 0.614
Bi-occular Width Index	1.378 ± 0.063	1.366 ± 0.078	1.397 ± 0.061	1.391 ± 0.067	1.403 ± 0.068
Mouth-Nose Width Index	1.306 ± 0.135	-	1.379 ± 0.119	1.324 ± 0.123	1.240 ± 0.076
Biocculr Mouth Width Index	1.604 ± 0.161	-	1.519 ± 0.106	1.576 ± 0.136	1.640 ± 0.124
Inter-Occular Nasal Width Index	0.756 ± 0.093	0.836 ± 0.113	0.765 ± 0.095	0.744 ± 0.096	0.733 ± 0.096
Upper Face Forehead HT. Index	1.323 ± 0.295	1.129 ± 0.165	1.225 ± 0.180	1.237 ± 0.221	1.171 ± 0.147
Upper-Lower Face Height Index	0.978 ± 0.112	0.941 ± 0.071	0.993 ± 0.110	0.969 ± 0.119	0.933 ± 0.113
Lower Face-Forehead Ht. Index	1.355 ± 0.275	1.207 ± 0.199	1.238 ± 0.169	1.279 ± 0.186	1.260 ± 0.179
Lower Face Prop. Index	3.049 ± 0.345	3.071 ± 0.299	3.212 ± 0.373	3.097 ± 0.374	3.043 ± 0.280
Nasal Height Prom. Index	1.848 ± 0.327	1.725 ± 0.271	1.740 ± 0.241	1.812 ± 0.222	1.835 ± 0.293
Nasal Prom. Bridge Index	2.510 ± 1.307	1.747 ± 0.320	2.156 ± 0.646	2.166 ± 0.642	2.383 ± 1.610
Whole Upper Lip Vert. Index	1.964 ± 0.317	1.881 ± 0.328	2.043 ± 0.370	2.030 ± 0.291	2.013 ± 0.355
Lower Face Height Vertical Index	1.578 ± 0.212	1.660 ± 0.228	1.600 ± 0.213	1.540 ± 0.176	1.544 ± 0.233
Nasal Columella Length Index	6.637 ± 2.220	6.920 ± 2.934	6.101 ± 1.876	6.733 ± 2.813	6.800 ± 1.566
Lateral Prop. Index I	1.609 ± 0.100	1.658 ± 0.071	1.686 ± 0.093	1.685 ± 0.109	1.635 ± 0.103
Lateral Prop. Index II	1.363 ± 0.103	1.360 ± 0.108	1.386 ± 0.098	1.440 ± 0.124	1.417 ± 0.121
Lateral Prop. Index III	1.187 ± 0.103	1.224 ± 0.088	1.220 ± 0.075	1.175 ± 0.085	1.157 ± 0.067
Nasal Prom. Lateral Index	5.602 ± 0.825	5.579 ± 0.643	5.515 ± 0.698	5.468 ± 0.663	5.358 ± 0.511
Nasal Bridge Lateral Index	14.098 ± 8.037	9.698 ± 1.724	11.863 ± 3.786	11.893 ± 3.943	12.591 ± 8.132

Table 6.16 Indices computed using one view only (continued)

VARIABLES	LEVELS OF SIGNIFICANCE FROM MANN - WHITNEY U TEST									
	HEHE v TUTSI	HEHE v SUKU	HEHE v NYAK	HEHE v KINGA	TUTSI v SUKU	TUTSI v NYAK	TUTSI v KINGA	SUKU v NYAK	SUKU v KINGA	KINGA v NYAK
Ear Protr. Index	-	-	1%	-	-	1%	5%	1%	-	-
Mouth Index	-	5%	5%	5%	-	-	-	-	-	-
Lip Index	-	-	-	-	-	-	-	-	-	-
Eye Fiss. Index	5%	1%	1%	1%	-	-	-	1%	-	-
Occular Index	-	-	-	-	-	-	-	-	-	-
Mouth Width Index	-	5%	-	-	-	-	-	5%	1%	5%
Nasal Brdth. Index	1%	-	-	-	1%	1%	1%	-	-	-
Inter-Occ. Wth. Index	-	-	-	-	-	-	-	-	-	-
Bi-Occular Wth. Index	-	-	-	-	-	-	-	-	-	-
Mouth-Nose Wth. Index	-	1%	-	5%	-	-	1%	-	1%	1%
Biocc-Mouth Wdth. Index	-	1%	-	-	-	-	-	-	1%	5%
Int.Occ.Nas. Wdth. Index	5%	-	-	-	5%	5%	5%	-	-	-
Upp. Face Frhd.Ht.Ind.	5%	5%	-	-	-	-	-	-	-	-
Upp-Low.Fce. Ht. Index	-	-	-	-	-	-	-	-	-	-
Lower Face Frhd.Ht.Ind.	-	1%	-	-	-	-	-	-	-	-
Lower Face Prop.Index	-	1%	-	-	-	-	-	-	-	-
Nasal Height Prom.Index	-	5%	-	-	-	-	-	-	-	-
Nasal Prom. Brid.Index	5%	-	-	-	5%	5%	-	-	-	-
Whole Upper Lip Vert.Ind	-	-	-	-	-	-	-	-	-	-
Low.Fac.Ht. Vert.Index	-	-	-	-	-	-	-	-	-	-
Nasal Col. Lth.Index	-	-	-	-	-	-	-	-	5%	-
Lat. Prop Index I	-	1%	1%	-	-	-	-	-	-	-
Lat. Prop. Index II	-	-	1%	1%	-	-	-	5%	-	-
Lat. Prop. Index III	-	5%	-	-	-	-	5%	5%	1%	-
Nasal Prom. Lat. Index	-	-	-	-	-	-	-	-	-	-
Nasal Brid. Lat. Index	5%	-	-	-	-	-	-	-	-	-

Table 6.16(b) Significant Variables from Mann - Whitney U Test

VARIABLES	HEHE MA REST TANZ MA		TUTSI MA REST TANZ MA		SUKUMA MA REST TANZ MA		NYAKYUSA MA REST TANZ MA		KINGA MA REST TANZ MA	
	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev
Ear Protr. Index			✓					✓		
Mouth Index		✓								
Lip Index										
Eye Fiss. Index		✓				✓	✓			
Occular Index										
Mouth Wdth. Index						✓			✓	
Nasal Brdth Index										
Int.-Occul. Wdth.Index										
Biocculer Wdth.Index										
Mouth-Nose Wdth.Index			✓			✓				✓
Biocc.-Mth. Wdth.Index						✓			✓	
Int.Occ.Nas Wdth.Index			✓							
Upper-Face Frhd.Ht.Ind	✓									
Upp.Low.Fac. Ht. Index										
Low.FaceFrd. Ht. Index		✓			✓					
Lower Face Prop.Index	✓					✓				
Nasal Ht. Prom.Index										
Nasal Prom. Bridge Ind.	✓		✓							
Whole Upper LipVert.Ind										
Low.Facial Ht.Vert.Ind										
Nasal Col. Lat. Index										

Table 6.16(b) Significant Variables from Mann - Whitney U Test (continued)

VARIABLES	HEHE MA REST TANZ MA		TUTSI MA REST TANZ MA		SUKUMA MA REST TANZ MA		NYAKYUSA MA REST TANZMA		KINGA MA REST TANZ MA	
	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev	SigAt 5%lev	SigAt 1%lev
Lat. Prop. Index I		✓				✓		✓		
Lat. Prop. Index II		✓						✓		
Lat. Prop. Index III						✓			✓	
Nasal Prom. Lat.Index										
Nasal Brdge Lat.Index	✓									

the differences shown between each of the two pairs is the smallest. Exactly the same differences are shown for Columella Length while, for the Nasal Height, only the Hehe v Tutsi combination is not significant. For the Nasal Bridge Distance the order of highest to lowest value is Nyakyusa, Sukuma, Tutsi and Hehe. There are only two highly significant differences shown here and those are in the comparisons between Hehe and Sukuma, and Hehe and Nyakyusa. In other words between the population having the smallest Nasal Bridge Distance and the two populations with the largest distances.

The Hehe have the largest Nasal Angle followed by Nyakyusa, Kinga, Sukuma and Tutsi. One significant difference, at the 1% level, was shown between Hehe and Sukuma and two significant differences are shown at the 5% level between Hehe and Tutsi, and Sukuma and Nyakyusa.

There is only one difference which is highly significant for the Nasal Base Angle and that is between Hehe and Sukuma. There are no significant differences shown between the populations for the relation--ship of the Nasal region with the vertical. For the Nasal Wing/Septum Relationship there is a highly significant difference between Hehe and Sukuma and also significant differences between Hehe and Kinga, Tutsi and Sukuma. These differences are due to the variation of percentage frequency of the +/+ variety (see Table 6.15).

From Table 6.12, which shows the results of indices computed using both profile and frontal views, the Nasal Bridge Index, Nasal Prominence and Nasal Index can be extracted. The Nasal Bridge Index is largest in the Tutsi followed by the Sukuma, Nyakyusa and then the Hehe. The difference between the Nasal Bridge Indices of the Hehe and Tutsi (i.e. largest and smallest values) is highly significant. While the differences between Hehe and Sukuma, Hehe and Nyakyusa and, Tutsi and Nyakyusa are significant at the 5% level. The Nasal Prominence Index shows significant differences between Hehe and Sukuma, and Hehe and Nyakyusa. The Nasal Index is largest in the Tutsi followed in descending order by the Sukuma, Nyakyusa and Hehe. There are highly significant differences shown between Hehe and Tutsi, Hehe and Sukuma, and Hehe and Nyakyusa.

Table 6.16 shows results of indices computed using one view only. The Nasal Height-Prominence Index shows a significant difference between Hehe and Sukuma. The Nasal Prominence - Bridge Index shows significant differences between the Hehe and Sukuma, Tutsi and Sukuma, and Tutsi and Nyakyusa. The Nasal Columella Length Index shows one significant difference between Sukuma and Kinga.

6.3(f) Mouth and Lips

From Table 6.10 the values for Mouth Width is largest for the Nyakyusa followed by Sukuma and Hehe in descending order. There is no value for Tutsi because too many had not adopted the correct rest position. Significance was shown for the differences between all possible combinations of populations.

The values for Upper Lip Height, Lower Lip Height and Total Lip Height are largest in the Nyakyusa followed by Sukuma, Tutsi and Hehe. There are highly significant differences between Hehe and Sukuma, and, Hehe and Nyakyusa. The values for the Height of the Whole Upper Lip are largest in the Nyakyusa followed in descending order of largeness by the Sukuma, Hehe and Tutsi. Significant differences are shown in all apart from Hehe and Tutsi and, Sukuma and Nyakyusa (the two largest and two smallest differences between which are smallest).

There are no significant differences shown between any popula--tions for Upper Lip Angle, which varies between 27 - 32 degrees, and the Labial Relationship with the Vertical, almost all are protracted. There is no significant difference either for the Lip Index. The Mouth Index values are greatest in the Hehe followed by Nyakyusa, Sukuma and Kinga in that order (no Tutsi included). There are significant differences between Hehe and Sukuma, Hehe and Nyakyusa, and Hehe and Kinga. From Table 6.16

the Biocular - Mouth Width Index shows one difference which is highly significant between the Hehe and Sukuma. The Whole Upper Lip Vertical Index shows no significant differences between any of the populations.

6.3(g) Chin

There are no significant differences shown in the values for Chin Angle or Mandibular Vertical Relationship. There is one difference which is highly significant between Hehe and Sukuma for the Lower Facial Proportion Index. No significant differences are shown in the values for the Lower Facial Height Vertical Index and the Upper - Lower Facial Height Index between any of the combinations of the five tribes.

6.3(h) Lateral Proportions

From Table 6.16 the three Lateral Proportion Indices all show some significant differences among the tribes. For Index I there are highly significant differences between Hehe and Sukuma, and Hehe and Nyakyusa. The Hehe have the smallest value whilst the Sukuma and Nyaky--usa have the largest. For Index II highly significant differences are shown for Hehe compared with Nyakyusa, and for Hehe with Kinga. Sukuma compared with Nyakyusa also shows a significant difference. Hehe has the smallest value for Index II, Nyakyusa has the largest followed by Kinga with the second largest value. Index III shows significant differ--ences at the 1% level for Sukuma compared with Kinga and at the 5% level for Tutsi with Kinga and Sukuma with Nyakyusa. Hehe has the larg--est value for Lateral Proportion Index III followed by Tutsi, Sukuma, Nyakyusa and Kinga in that order.

6.3(i) Chi-Square Test

The x^2 value is larger than any values listed in the x^2 tables for just two classes. Therefore there is less than one chance in one hundred that these results could have happened by chance alone.

Table 6.17 Standardized Discriminant Function Coefficients

Populations:- Heho MA
Tutsi MA
Sukuma MA
Nyakyusa MA

VARIABLES	COEFFICIENTS
FUNCTION 1	
Biocular Diameter	-2.96629
Biocular Width Index	-1.95855
Auricle - Chin Distance	-0.89832
Eye Fissure Index	0.72578
Chin Angle	0.60922
Lower Face - Forehead Height Index	0.44219
Mouth Index	0.26562
FUNCTION 2	
Height of Upper Face	1.12360
Left Eye Fissure Height	0.97488
Upper Face - Forehead Height Index	-0.86929
Left Eye Fissure Width	-0.65605
Nasal Angle	-0.48917
Nasal Prominence Lateral Index	-0.28807
Columella Length	-0.24145
Nasal Wing/Septum Relationship	-0.18599
FUNCTION 3	
Biaural Breadth	10.91393
Bizygomatic Diameter	-8.25460
Ear Protrusion Index	7.87660
Nasal Breadth	-6.25086
Nasal Breadth Index	-5.67851
Whole Upper Lip Vertical Index	1.59462
Nasal Height	-1.08283
Height of Whole Upper Lip	1.02189
Lateral Proportion Index I	-0.41591
Right Eye Fissure Width	-0.41037

6.3(i) Discriminant Function Analysis

The variables which most contribute to discriminating between the four groups Hehe, Sukuma, Nyakyusa and Tutsi are shown in Table 6.17. Table 6.20 shows the variable which contribute most to discriminating between Hehe, Kinga, Nyakyusa, Sukuma and Tutsi. Here the variables are confined to Indices using single views, angles and relationships because the Kinga photographs were unscaled and so absolute measurements and indices computed using the two views cannot be used.

In Table 6.17, the variables in Function 1 contribute to 74.22% of the total variance with Function 2 taking out 18.55% and Function 3, 7.23%.

In Table 6.20, Function 1 takes out 59.93% of the variance, Function 2; 19.16%, Function 3; 14.9% and Function 4 6.01%.

Figure 6.4a shows the scatterplot produced using the variables in Function 1 and 2 discriminating between Hehe (Group 1), Tutsi (Group 2), Sukuma (Group 3) and Nyakyusa (Group 4).

From the scatterplot it can be seen that the Hehe and Tutsi are grouped close together in fact Tutsi are contained within Hehe circle, and so to are the Sukuma and Nyakyusa. Sukuma is also close to Tutsi. These two pairs are well separated, however Figures 6.4 (b - e) show each of the groups around their centroids. This seems to suggest that the Hehe and Tutsi are closely related and so are the Sukuma and Nyakyusa but both groups are separated. The centroids of the Tutsi and Sukuma are closer than any other pair. These two tribes also occupy the upper part of the scatterplot whilst the Hehe and Nyakyusa occupy the lower portion. This appears to correspond to the actual geographical locations of the tribes within Tanzania. It is surprising, however, that the centroids of the Tutsi and Sukuma are closer together than is the case for the Hehe and Nyakyusa since the latter pair inhabit tribal territories in close proximity to one another. These affinities can

Figure 6.4(a) -Scatterplot for Tribes of Tanzania.

1 = Hehe M.A. ; 2 = Tutsi M.A. ; 3 = Sukuma M.A. ; 4 = Nyakyusa M.A.

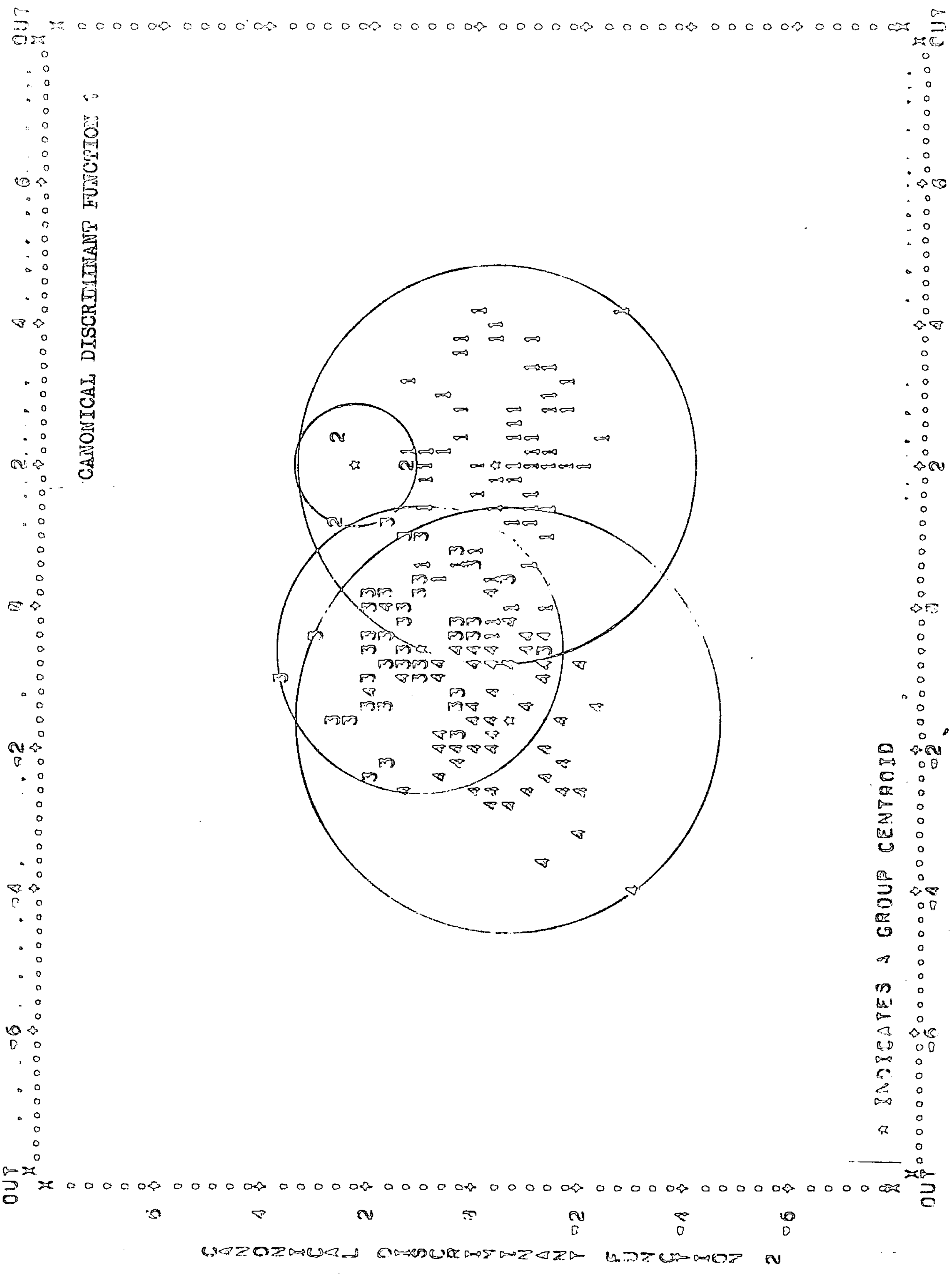


Figure 6.4(b)-Group 1 = Hoho M.A.

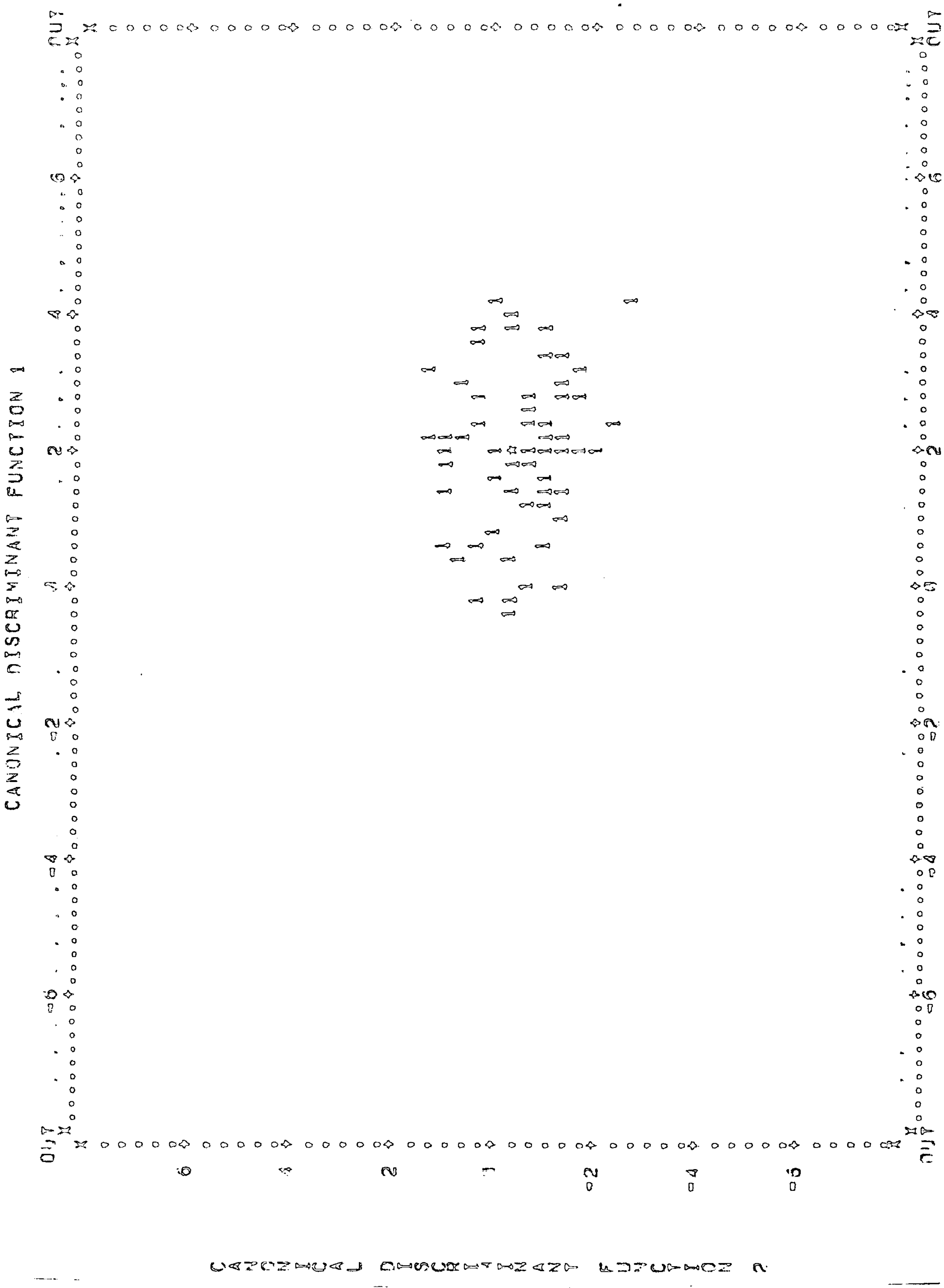


Figure 6.4(c) — Group 2 - Tutsi M.A.

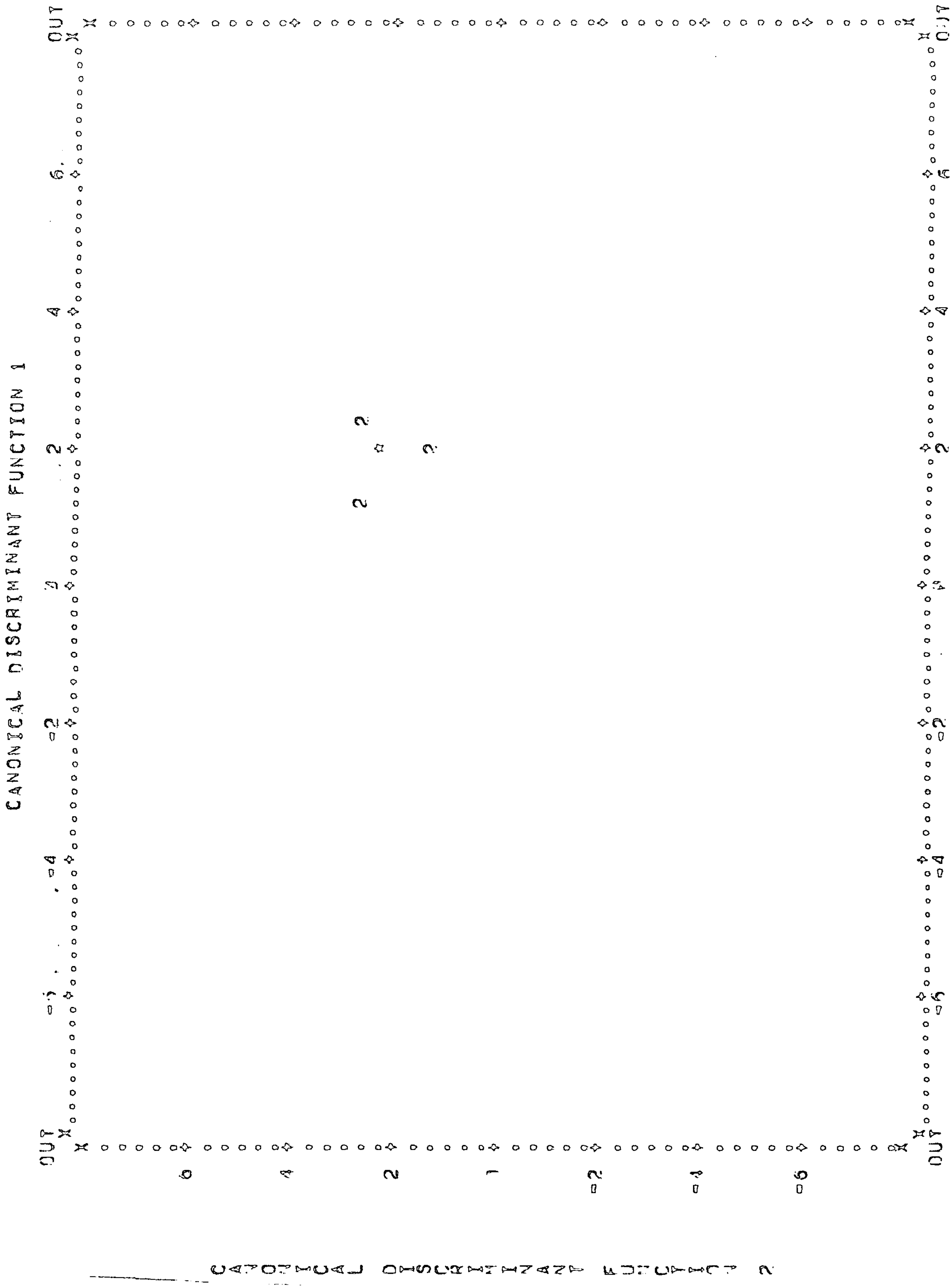
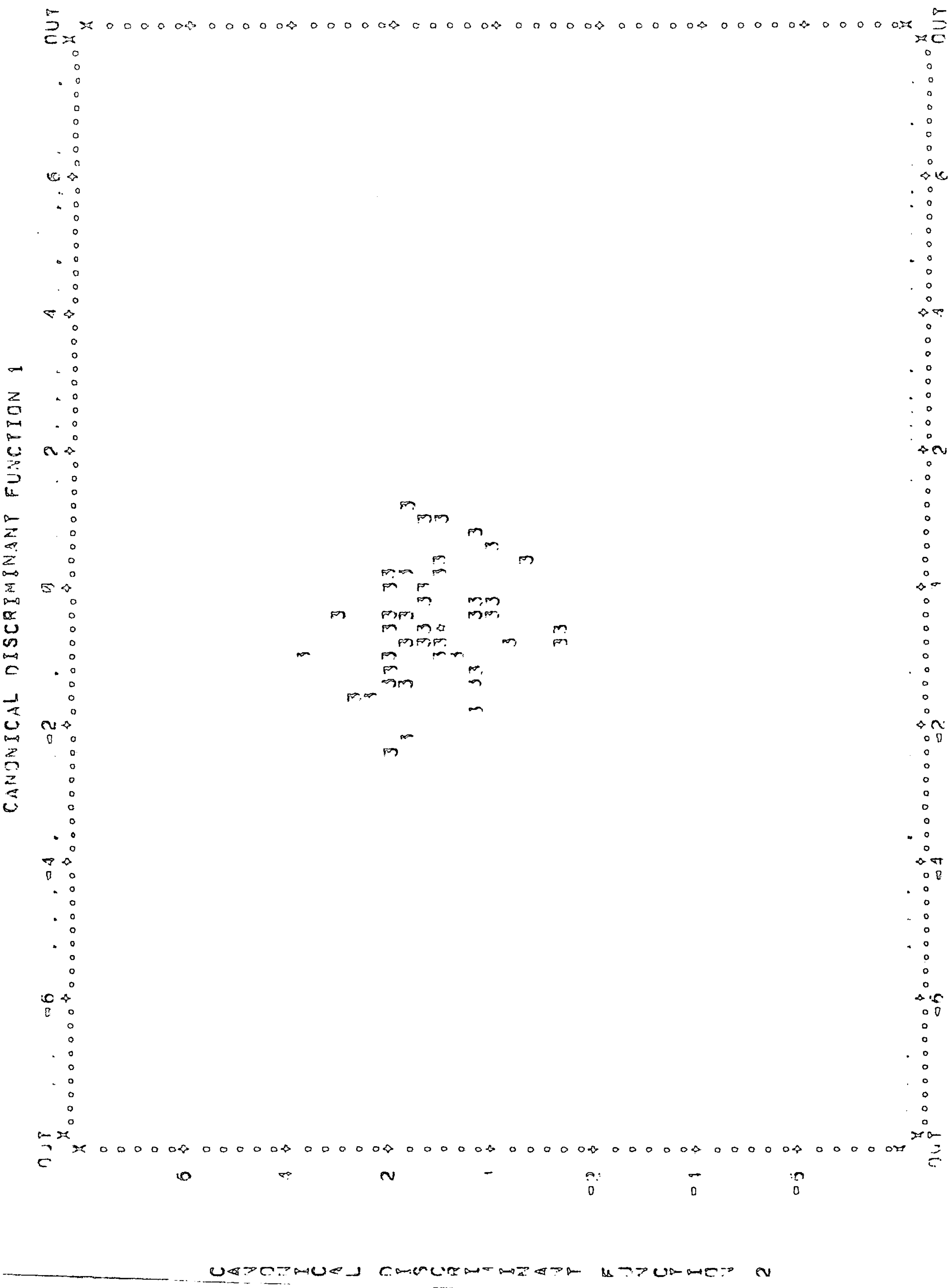


Figure 6.4(d) Group 3 = Sukuma M.A.



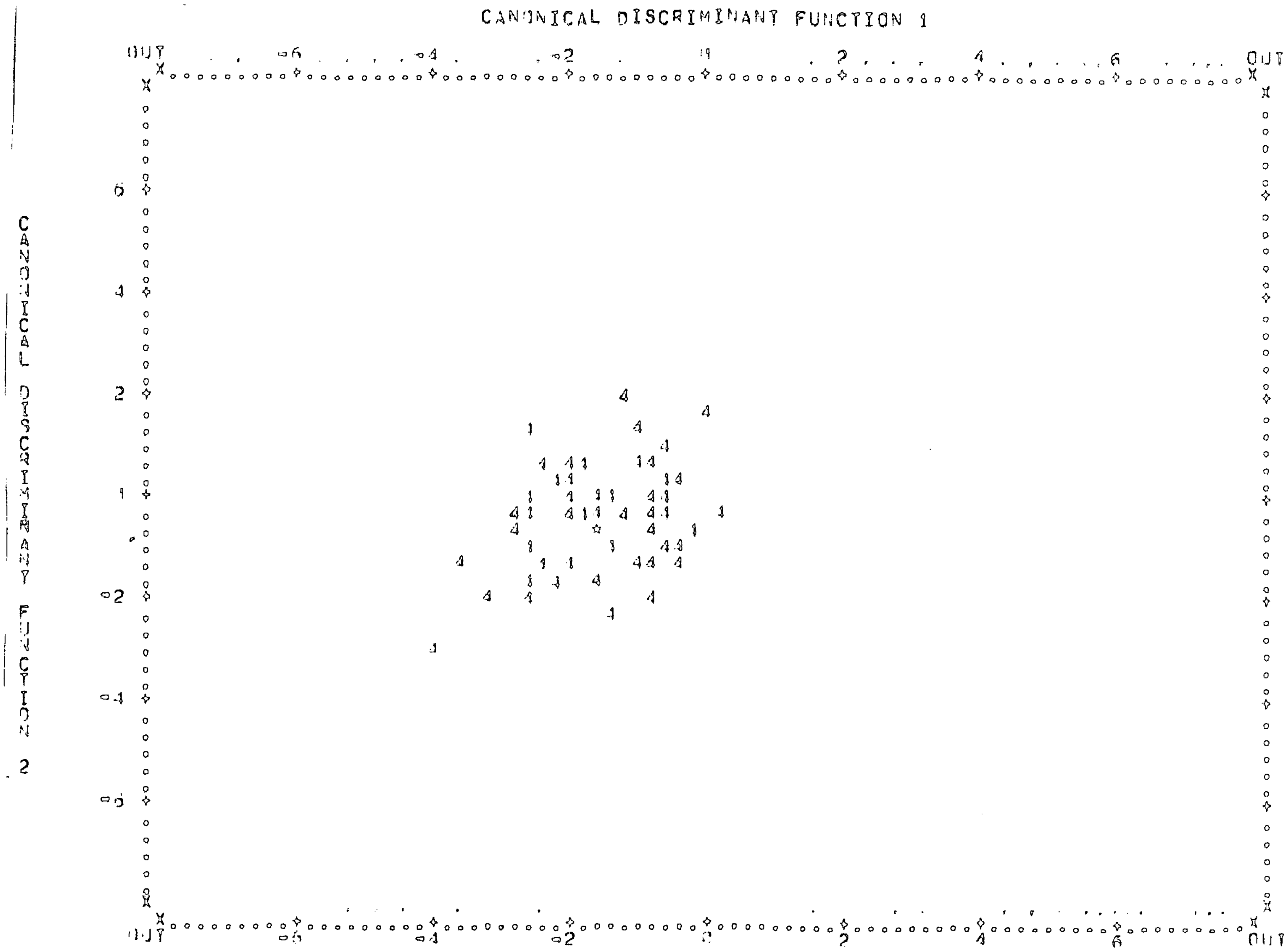


Figure 6.4(o). Group 4 = Nyakusa M.A.

be seen by looking at the F values and significances. The Tutsi and Sukuma are also closely related but Nyakyusa are removed.

Table 6.18 F statistics and significances between pairs of groups

GROUP	1 Heho MA	2 Tutsi MA	3 Sukuma MA
2 Tutsi MA	1.6610 0.0346		
3 Sukuma MA	10.0290 0.0000	2.6817 0.0001	
4 Nyakyusa MA	13.3480 0.0000	3.2882 0.0000	3.8942 0.0000

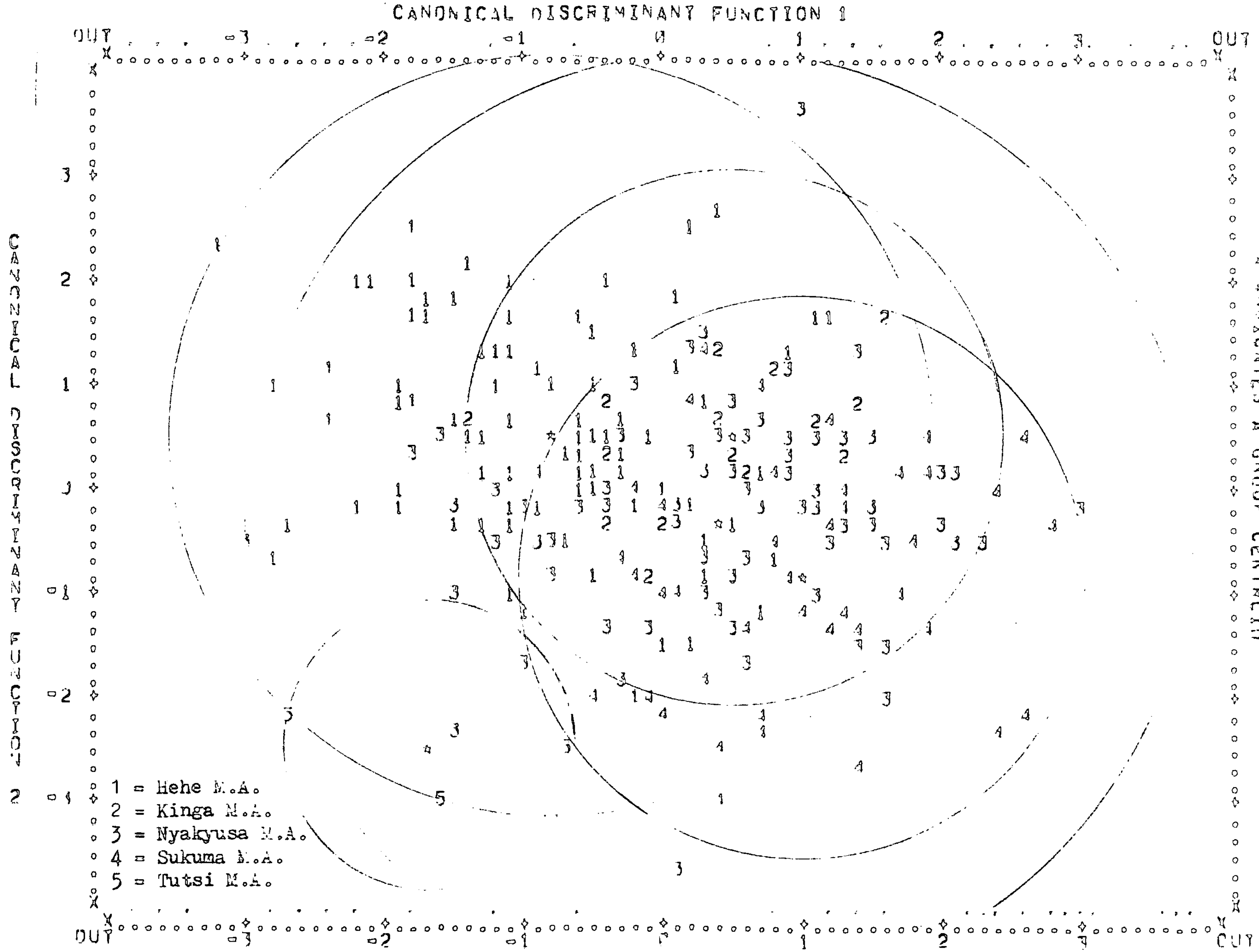
There are (from Table 6.18) highly significant differences between all of the groups apart from that between Heho and Tutsi which is significant at the 5 percent level. The greatest differences are between Nyakyusa and Heho, and Sukuma and Heho. Tutsi and Heho are closest together followed by Sukuma and Tutsi.

Table 6.19 shows the results of taking the individuals out of the groups and reclassifying them using the selected variables. As can be seen the percentage of grouped cases correctly classified is 85.53 percent.

The seven best variables for classifying (or discriminating) are Bioccular diameter, Bioccular Width Index, Auricle - Chin Distance, Eye Fissure Index, Chin Angle, Lower Face - Forehead Height Index and Mouth Index. These account for 74.22 percent of variance.

Figure 6.5(a) shows the scatterplot using the variables forming canonical discriminant functions 1 and 2 as specified in Table 6.20. Figures 6.5 b - f show the groups separately clustered around their centroids.

From this plot a different picture emerges. The Heho appear



☆ INDICATES A GROUP CENTROID

Figure 6.5(a) Scatterplot for tribes of Tanzania.

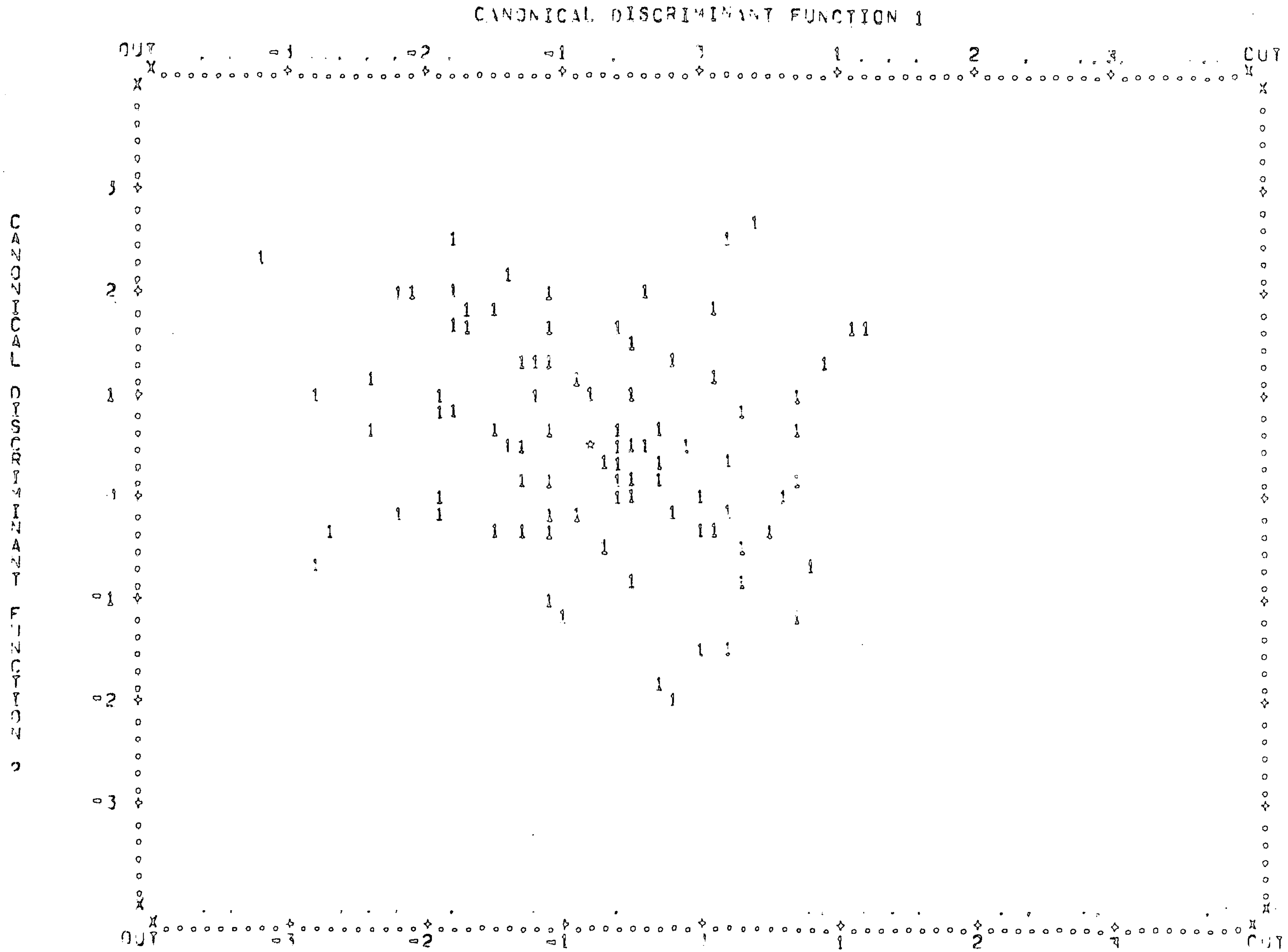


Figure 6.5(b) Group 1 = Hehe M.A.

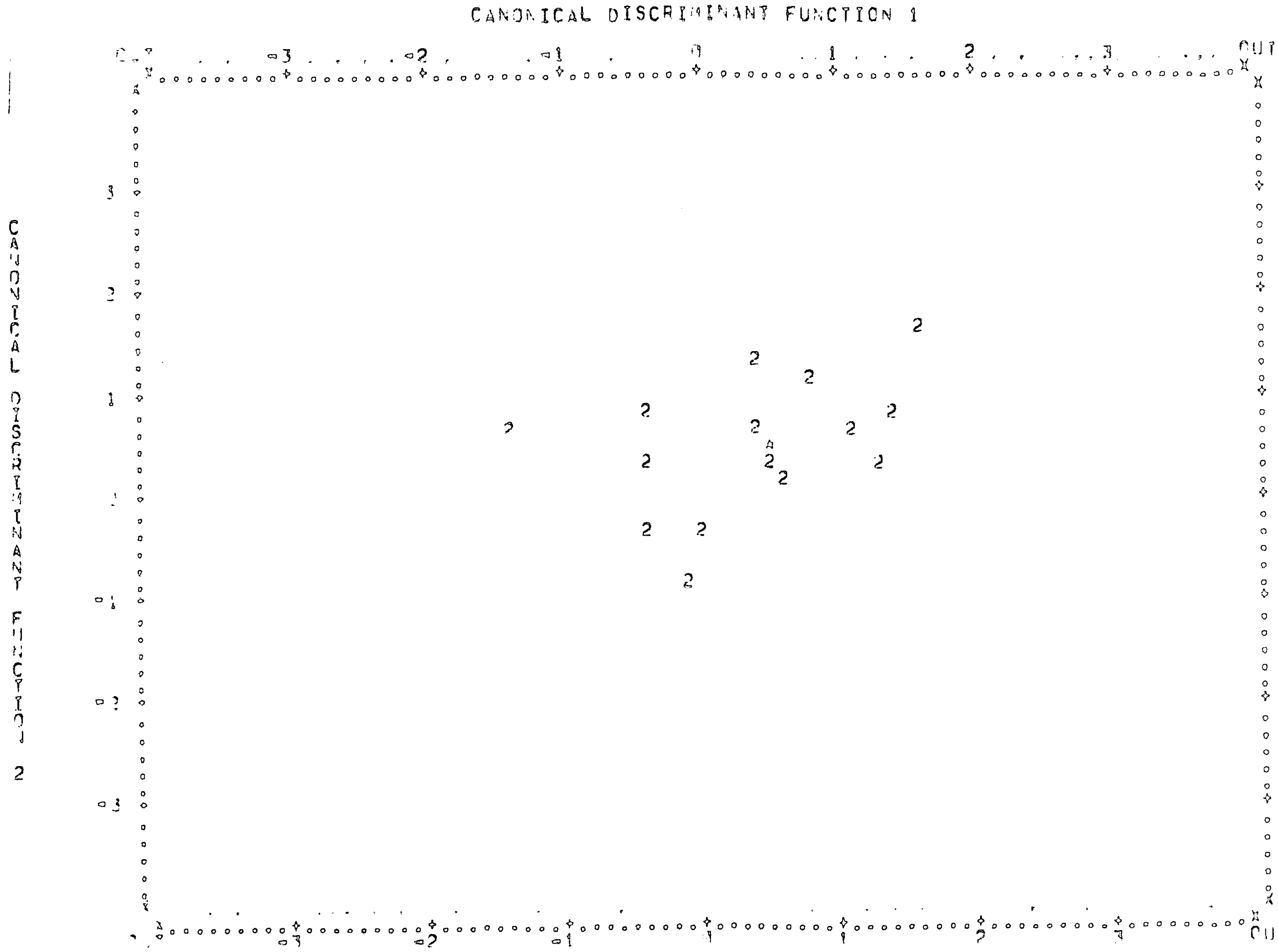


Figure 6.5(c) Group 2 Kinga M.A.

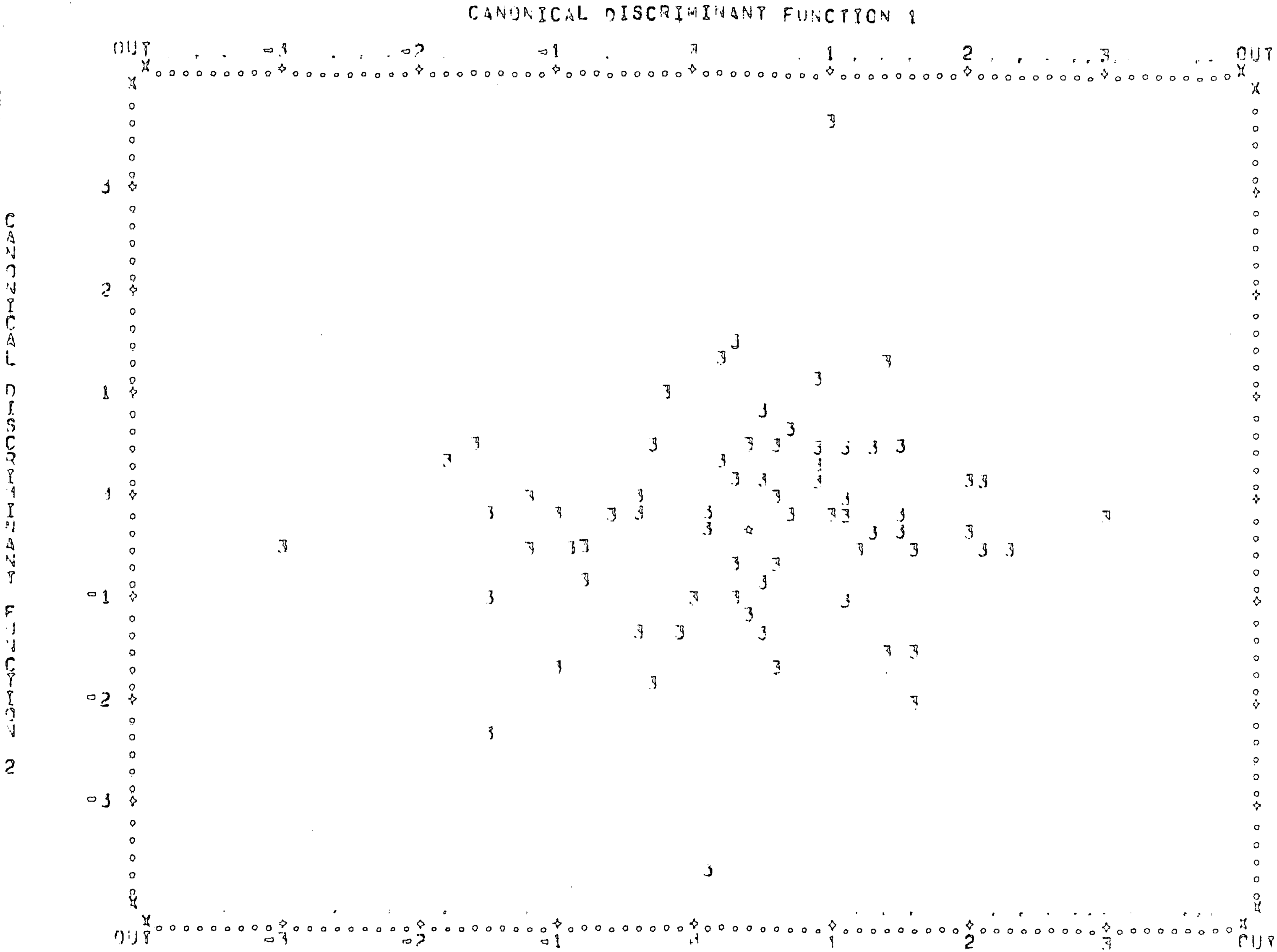


Figure 6.5(d) Group 3 = Nyakyusa M.A.

Figure 6.5(e) Group 4 - Sukuma M.A.

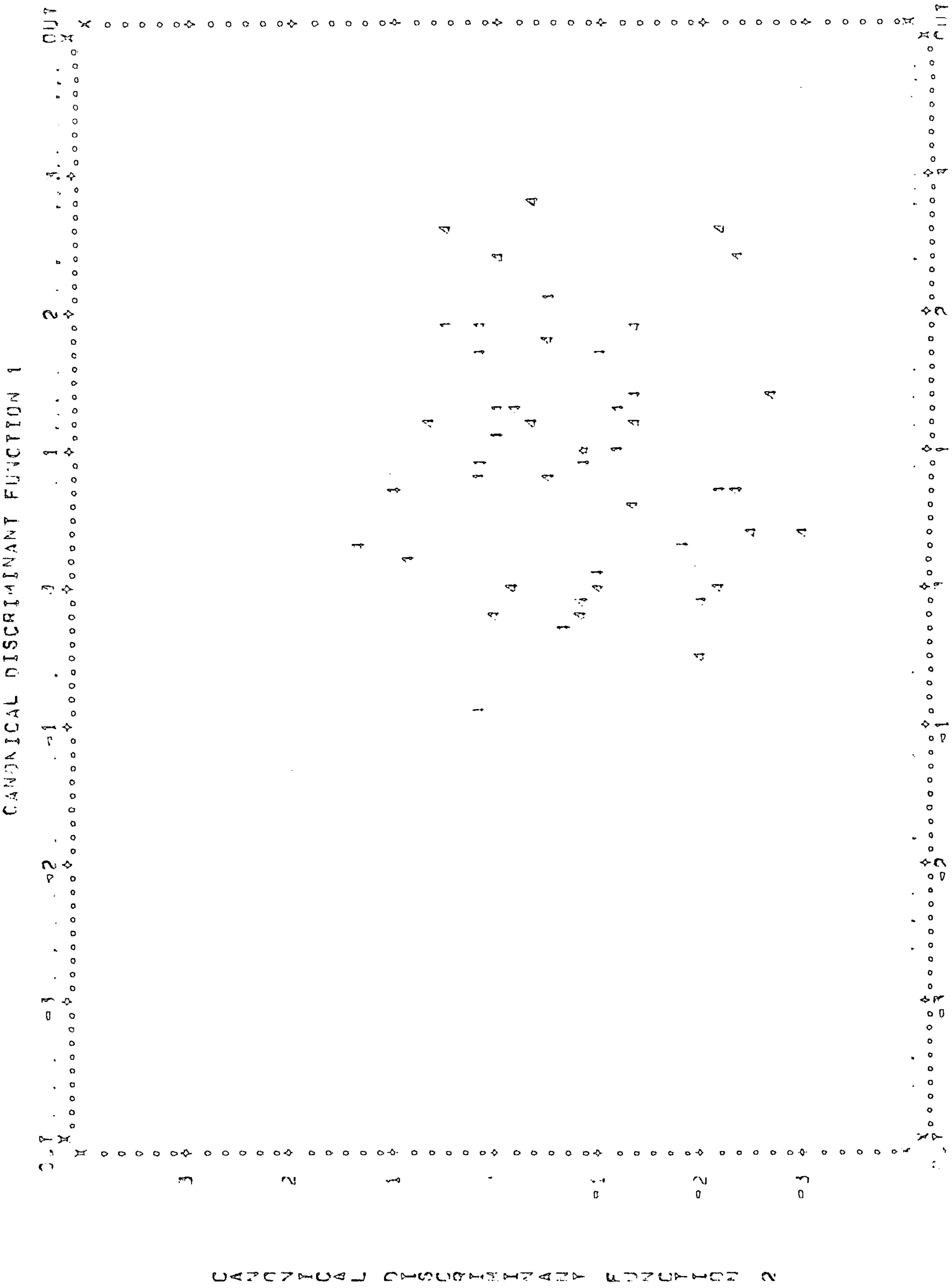
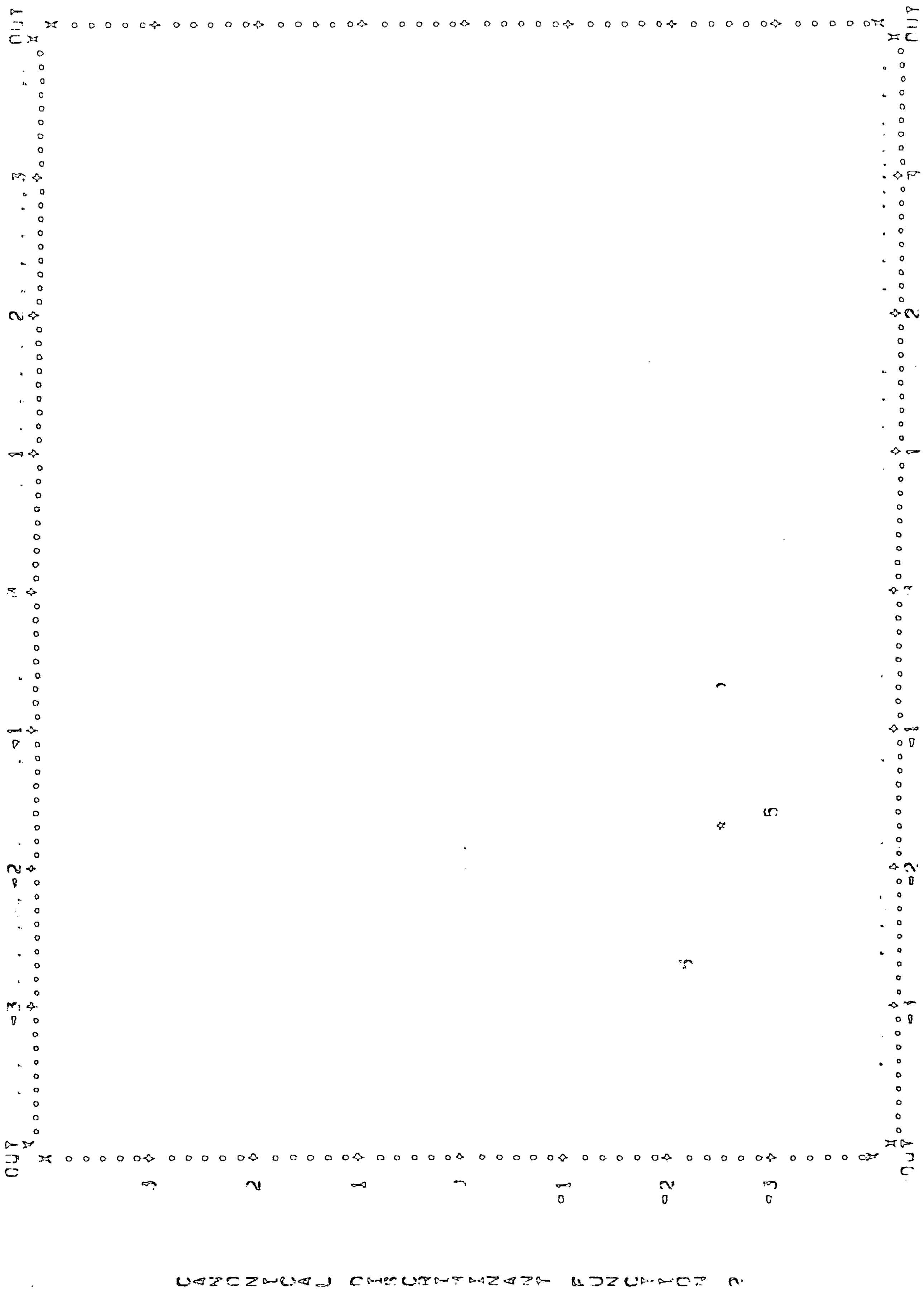


Figure 6.5(f) Group 5 = Tutsi M.A.



to be central, or average, close to them are the Kinga, Nyakyusa and Sukuma grouped closely together. The Tutsi, however, are separated a long distance from the rest. Of the three grouped close together the Kinga and Nyakyusa have their centroids very close and closer to the Hehe than the Sukuma which are farther removed.

Table 6.19 Classification Results

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP			
		1	2	3	4
Group 1 = Hehe MA	58	49 84.5%	2 3.4%	2 3.4%	5 8.6%
Group 2 = Tutsi MA	3	0 0.0%	3 100.0%	0 0.0%	0 0.0%
Group 3 = Sukuma MA	47	3 6.4%	0 0.0%	37 78.7%	7 14.9%
Group 4 = Nyakyusa MA	62	0 0.0%	0 0.0%	9 14.5%	53 85.5%

Table 6.21 F statistics and significances between pairs of groups

GROUP	1 Hehe	2 Kinga	3 Nyakyusa	4 Sukuma
2 Kinga	3.2758 0.0000			
3 Nyakyusa	7.4056 0.0000	2.3048 0.0026		
4 Sukuma	7.8023 0.0000	2.7385 0.0003	2.9791 0.0001	
5 Tutsi	1.5479 0.0760	2.1100 0.0065	1.5724 0.0689	1.4482 0.1115

As can be seen from Table 6.21 there are no significant differences between Tutsi and Sukuma, Tutsi and Nyakyusa and Tutsi and Hehe.

Table 6.20 Standardized Discriminant Function Coefficients

Populations:- Heho MA
Kinga MA
Nyakyusa MA
Sukuma MA
Tutsi MA

VARIABLES	COEFFICIENTS
FUNCTION 1	
Eye Fissure Index	-0.67041
Upper Face - Forehead Height Index	-0.55650
Bioccular - Mouth Width Index	-0.49205
Nasal Base Angle	0.41436
Lip Index	-0.41213
FUNCTION 2	
Mouth - Nose Width Index	-0.85255
Chin Angle	0.71422
Nasal Angle	0.62827
Mouth Index	0.35355
FUNCTION 3	
Ear Protrusion Index	-0.74264
Upper - Lower Facial Height Index	0.70473
FUNCTION 4	
Whole Upper Lip Vertical Index	2.25417
Lower Face Proportion Index	-1.70023
Lower Facial Height Vertical Index	1.33699
Lateral Proportion Index I	-0.77758
Frontal Recession Angle	-0.66616
Lateral Proportion Index II	0.51867
Frontal Protraction/Retraction	0.38564

Table 6.22 shows the results of reclassifying the individuals using the variables given. The classification is 63.75percent correct. A lower percentage than the other classifications se because of the close proximity and in fact overlapping relationships of the groups to one another.

Table 6.22 Classification Results

ACTUAL GROUPS	NO.OF CASES	PREDICTED GROUP MEMBERSHIP 1	2	3	4	5
Group 1	101	67 66.3%	8 7.9%	14 13.9%	9 8.9%	3 3.0%
Group 2	16	1 6.3%	13 81.3%	1 6.3%	1 6.3%	0 0.0%
Group 3	73	8 11.0%	10 13.7%	41 56.2%	9 12.3%	5 6.8%
Group 4	47	2 4.3%	4 8.5%	10 21.3%	29 61.7%	2 4.3%
Group 5	3	0 0.0%	0 0.0%	0 0.0%	0 0.0%	3 100.0%

Percentage of Grouped Cases Correctly Classified = 63.75 percent

Group 1 = Hehe MA

Group 2 = Kinga MA

Group 3 = Nyakyusa MA

Group 4 = Sukuma MA

Group 5 = Tutsi MA

The functions selected are shown in Table 6.20. The first two functions take out approximately 80 percent of the variance. These two functions were used for the scatterplots. They contain nine vari--ables which are thus the best discriminators. These are Eye Fissure Index, Upper Face - Forehead Height Index, Biocular - Mouth Width Index, Nasal Base Angle and Lip Index, all in Functions 1. In Functions 2; Mouth - Nose Width Index, Chin Angle, Nasal Angle and Mouth Index.

6.3(k) Hehe FA V Tutsi FA

Another inter-tribe comparison was made and this was between the female adults of the Hehe and Tutsi.

6.3k(i) Head and Size of Face

There was a highly significant difference between the Bizygo-matic Diameters of the Hehe and Tutsi female adults. The Hehe being on average larger. There was a significant difference in the Height of the Upper Face but no significant difference in the Height of Face. In both of these the Hehe had the larger values. The Orbit-Auricle Distance showed a highly significant difference between Hehe and Tutsi, and the Auricle - Chin Distance showed a significant difference the Hehe again being larger in both cases (see Table 6.23a). Table 6.25(b) shows that there is a highly significant difference in the General Facial Size Factor Index which again is greater for the Hehe. These results all suggest that the Hehe have larger faces in absolute terms than the Tutsi.

6.3k(ii) Forehead

There were no significant differences between Tutsi and Hehe female adults for Height of Forehead, Frontal Recession Angle or the Vertical Relationship of the Frontal Region. The Upper Face - Forehead Height Index was greater in the Hehe than the Tutsi and the difference was highly significant. This suggests that the upper face is larger in the Hehe. The Lower Face - Forehead Height Index showed the Hehe to be significantly larger again.

6.3k(iii) Eyes

The Hehe had highly significantly greater Inter - Occular Distances and Biocculár Diameters, as shown in Table 6.23(a). The Eye Fissure Width was significantly larger in the Hehe than the Tutsi but there were no significant differences in Eye Fissure Height, Eye Fissure Index, Occular Index, Inter - Occular Width Index or Biocculär Width Index.

Table 6.23(a) Absolute Measurements

VARIABLES	MEANS AND STANDARD DEVIATIONS		LEVEL OF SIGNIFICANCE
	HEHE FA n= 45	TUTSI FA n= 15	HEHE FA v TUTSI FA
Bizygomatic Diameter	149.222 ± 11.522	132.800 ± 4.057	1%
Biaural Breadth	171.909 ± 11.503	160.533 ± 5.579	1%
Nasal Breadth	50.422 ± 4.770	41.667 ± 3.867	1%
Inter-Occular Distance	40.644 ± 4.432	35.333 ± 3.658	1%
Bioccular Diameter	108.667 ± 8.586	96.533 ± 5.303	1%
Mouth Width	65.658 ± 6.019	59.667 ± 5.317	5%
Upper Lip Height	14.023 ± 2.415	12.909 ± 2.982	-
Lower Lip Height	15.488 ± 2.463	15.455 ± 2.806	-
Total Lip Height	29.558 ± 3.954	28.364 ± 5.591	-
Right Eye Fissure Height	11.156 ± 2.174	11.067 ± 1.223	-
Left Eye Fissure Height	11.333 ± 2.132	11.333 ± 1.877	-
Right Eye Fissure Width	33.222 ± 3.723	31.267 ± 2.789	5%
Left Eye Fissure Width	32.778 ± 3.490	31.200 ± 3.590	5%
Nasal Prominence	23.133 ± 2.873	23.538 ± 3.711	-
Nasal Bridge Distance	12.391 ± 4.318	12.692 ± 4.854	-
Nasal Height	44.500 ± 5.154	44.615 ± 4.788	-
Height of Whole Upper Lip	24.022 ± 2.785	20.231 ± 2.803	1%
Vertical Height of Lower Face	72.239 ± 6.812	67.923 ± 5.220	5%
Height of Forehead	55.800 ± 7.721	59.077 ± 6.435	-
Height of Upper Face	70.804 ± 5.636	65.692 ± 6.393	5%

Table 6.23(a) Absolute Measurements (continued)

VARIABLES	MEANS AND STANDARD DEVIATIONS		LEVEL OF SIGNIFICANCE
	HEHE FA n= 45	TUTSI FA n= 15	HEHE FA v TUTSI FA
Orbit-Auricle Distance	85.711 ± 5.546	80.308 ± 4.461	1%
Auricle-Chin Distance	141.356 ± 7.532	135.462 ± 10.875	5%
Height of Face	116.696 ± 9.357	112.846 ± 8.543	-
Columella Length	7.826 ± 1.051	7.077 ± 1.754	-

Table 6.23(b) Angles

VARIABLES	MEANS AND STANDARD DEVIATIONS		LEVEL OF SIGNIFICANCE
	HEHE FA n= 62	TUTSI FA n= 13	HEHE FA v TUTSI FA
Nasal Angle	58.903 ± 4.891	59.846 ± 4.964	-
Nasal Base Angle	8.952 ± 4.389	8.385 ± 3.330	-
Upper Lip Angle	27.419 ± 9.659	34.154 ± 10.221	5%
Chin Angle	- 7.919 ± 4.740	- 10.615 ± 6.292	-
Frontal Recession Angle	74.742 ± 5.848	73.769 ± 6.685	-

Table 6.24 Relationships

VARIABLES	PERCENTAGE FREQUENCIES		LEVELS OF SIGNIFICANCE
	HEHE FA n= 63	TUTSI FA n= 13	HEHE FA v TUTSI FA
NASAL WING - SEPTUM REL.			-
+/+	76.2	100.0	
+/-	12.7	0.0	
-/+	0.0	0.0	
+/0	7.9	0.0	
0/+	3.2	0.0	
-/0	0.0	0.0	
FRONTAL			-
Protraction	68.3	53.8	
Retraction	30.2	46.2	
Vertical	1.6	0.0	
NASAL			-
Protraction	31.7	7.7	
Retraction	63.5	92.3	
Vertical	4.8	0.0	
LABIAL			-
Protraction	100.0	100.0	
Retraction	0.0	0.0	
Vertical	0.0	0.0	
MANDIBULAR			-
Protraction	41.3	38.5	
Retraction	54.0	61.5	
Vertical	4.8	0.0	

Table 6.25(a) Indices

VARIABLES	MEANS AND STANDARD DEVIATIONS		LEVELS OF SIGNIFICANCE
	HEHE FA n= 62	TUTSI FA n= 15	HEHE FA v TUTSI FA
Ear Prot. Index	0.869 ± 0.041	0.828 ± 0.029	1%
Mouth Index	2.249 ± 0.370	-	x
Lip Index	0.939 ± 0.189	0.837 ± 0.131	-
Eye Fissure Index	2.988 ± 0.463	2.809 ± 0.276	-
Occular Index	2.734 ± 0.262	2.750 ± 0.225	-
Mouth Width Index	2.295 ± 0.257	-	x
Nasal Breadth Index	2.965 ± 0.203	3.210 ± 0.281	1%
Inter-Occular Width Index	3.763 ± 0.363	3.790 ± 0.341	-
Bioccular Width Index	1.379 ± 0.076	1.378 ± 0.056	-
Mouth-Nose Width Index	1.303 ± 0.134	-	x
Biocc-Mouth Width Index	1.666 ± 0.180	-	x
Inter-Occular Nas.Wdth.Index	0.795 ± 0.091	0.853 ± 0.101	5%
Upper Face-Frhd.Ht.Index	1.290 ± 0.260	1.122 ± 0.147	1%
Upper-Lower Face Ht.Index	0.987 ± 0.099	0.969 ± 0.083	-
Lower Face-Frhd.Ht.Index	1.309 ± 0.226	1.158 ± 0.113	5%
Lower Face Prop.Index	3.052 ± 0.338	3.399 ± 0.398	1%
Nasal Height-Prom.Index	1.959 ± 0.291	1.916 ± 0.188	-
Nasal Prom.-Bridge Index	2.220 ± 0.927	2.165 ± 1.014	-
Whole Upp.Lip Vert. Index	1.912 ± 0.262	2.239 ± 0.375	1%
Low.Fac. Ht. Vert.Index	1.611 ± 0.194	1.538 ± 0.203	-

Table 6.25(a) Indices (continued)

VARIABLES	MEANS AND STANDARD DEVIATION		LEVELS OF SIGNIFICANCE
	HEHE FA n= 62	TUTSI FA n= 15	HEHE FA v TUTSI FA
Nasal Col. Length Index	6.066 ± 1.465	6.762 ± 2.205	-
Lateral Prop. Index I	1.643 ± 0.072	1.686 ± 0.072	-
Lateral Prop. Index II	1.370 ± 0.083	1.406 ± 0.093	-
Lateral Prop. Index III	1.203 ± 0.072	1.203 ± 0.082	-
Nasal Prom. Lat. Index	6.124 ± 0.706	5.882 ± 1.022	-
Nasal Bridge Lat. Index	13.485 ± 5.527	12.557 ± 5.745	-

Table 6.25(b) Indices using both views

VARIABLES	MEANS AND STANDARD DEVIATIONS		LEVELS OF SIGNIFICANCE
	HEHE FA n= 45	TUTSI FA n= 15	HEHE FA v TUTSI FA
General Facial Size Factor	4.925 ± 0.274	4.608 ± 0.225	1%
Nasal Bridge Index	2.544 ± 0.889	2.735 ± 0.985	-
Nasal Prom. Index	4.690 ± 0.571	5.105 ± 0.745	-
Nasal Index	0.886 ± 0.089	1.087 ± 0.141	1%

6.3k(iv) Ears

The Biaural Breadth was highly significantly greater in the Heho than the Tutsi (Table 6.23(a)) as was the Ear Protrusion Index (Table 6.25a). This again shows the Heho to have larger faces in absolute terms and that their ears protrude more in relative terms.

6.3k(v) Nose

The Nasal Breadth Index, which is a measure of the width of the nose in relation to the width of the face, was highly significantly larger in the Tutsi than the Heho, so too was Inter - Occular Nasal Width Index. These results suggest that although the Heho's noses are wider in absolute terms the Tutsi's are wider relative to their facial widths. The Nasal Index, which is Nasal Height divided by Nasal Breadth, was larger in the Heho and since there was no significant difference in Nasal Heights this again suggests the Tutsi's noses are wider relative to face width than the Heho's. There were no significant differences in Nasal Prominence, Nasal Bridge Distance, Columella Length, Nasal Height, Nasal Angle, Nasal Wing / Septum relationship, or Nasal Region Vertical relationship. There were no significant differences in any of the indices concerned with the nose (see Table 6.25a) apart from the Nasal Index and Inter -Occular - Nasal Width Index already mentioned.

6.3k(vi) Mouth and Lips

There were significant (at 5 percent level) differences in Mouth Width and Upper Lip Angle (see Table 6.23) Heho having the larger Mouth Width and Tutsi the greater Upper Lip Angle. There were no more significant differences in any other of the variables concerned with the lips and mouth.

6.3k(vii) Chin

There was only one highly significant difference shown in the variables concerned with the chin region. This was in the Lower Facial

Proportion Index. Tutsi had the higher value suggesting the Hehe had the larger chin vertically in proportion to the lower facial height. No other significant differences were shown.

6.3k(viii) Lateral Proportions

There were no significant differences shown in the Lateral Proportion Indices I,II and III.

6.3k(ix) Discriminant Function Analysis

The variables which can best be used to discriminate between the Hehe and Tutsi female adults are shown in Table 6.26. There are eleven out the sixty four which were measured using these histograms were plotted see Figure 6.6 (a - c). As can be seen the two groups separate out quite nicely and overlap just a little. Table 6.27 shows classification results and 89.47 percent of the grouped cases were correctly classified. Function 1 is thus a good discriminator.

The F statistic for discriminating between Hehe FA and Tutsi FA is very high 16.371 and the significance is 0.0000 or highly significant.

6.4 The North-East of Britain compared with the Rest of Great Britain

Table 6.28 shows the variables which show significant or highly significant differences when the populations of the North-East of Great Britain and the Rest of Great Britain were compared for the measurements taken and indices calculated. In each case the sexes were kept separate and the regional comparisons only were made.

6.4(a) Head and Size of Face

The Height of the Upper Face showed a significant difference between the North-Eastern males and the males of the Rest of Great Britain. Highly significant differences were shown between the North-Eastern males and the Rest of Great Britain males for Orbit - Auricle Distance, Auricle - Chin Distance and General Facial Size Factor. In all

Figure 6.6(a) Stacked Histogram for Hehe F.A. & Tutsi F.A.

Group 1 = Hehe F.A. Group 2 = Tutsi F.A.

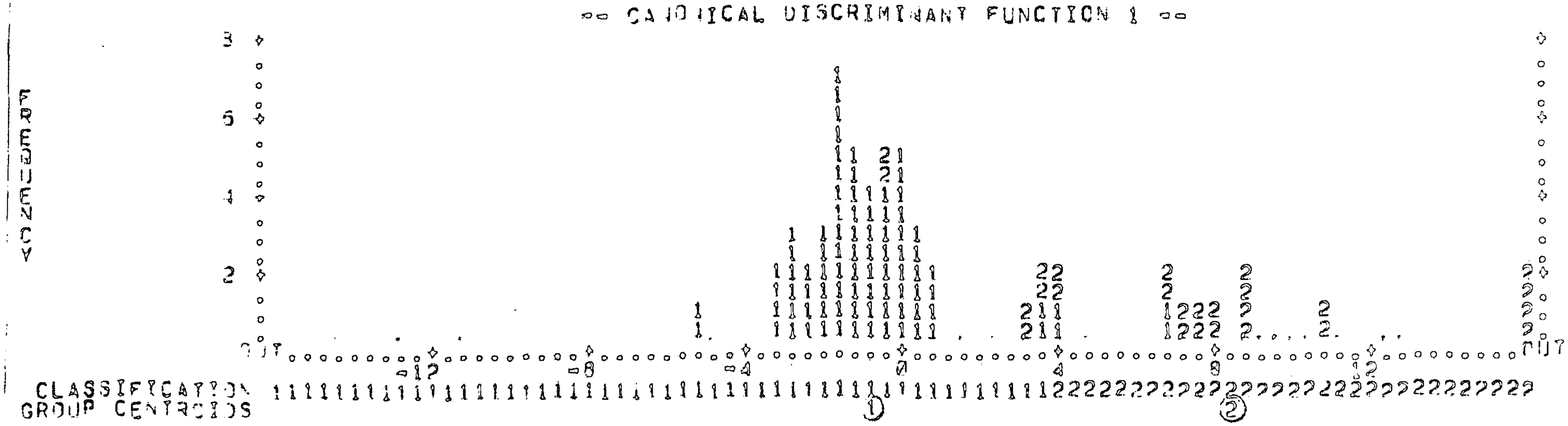


Figure 6.6(b) Histogram for Group 1 = Hehe F.A.

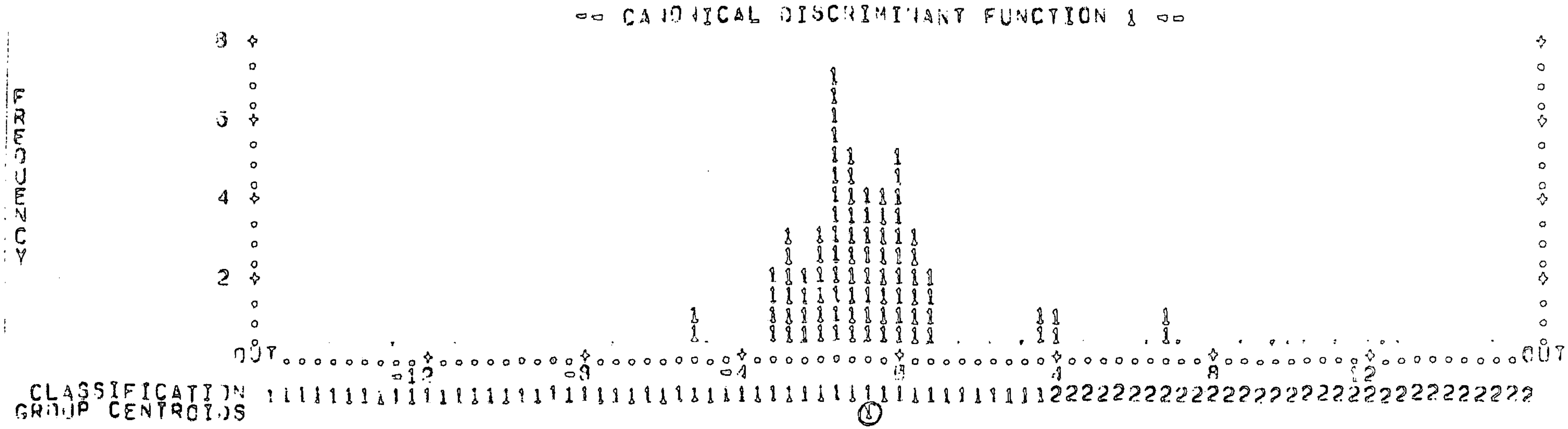


Figure 6.6(c) Histogram for Group 2 = Tutsi F.A.

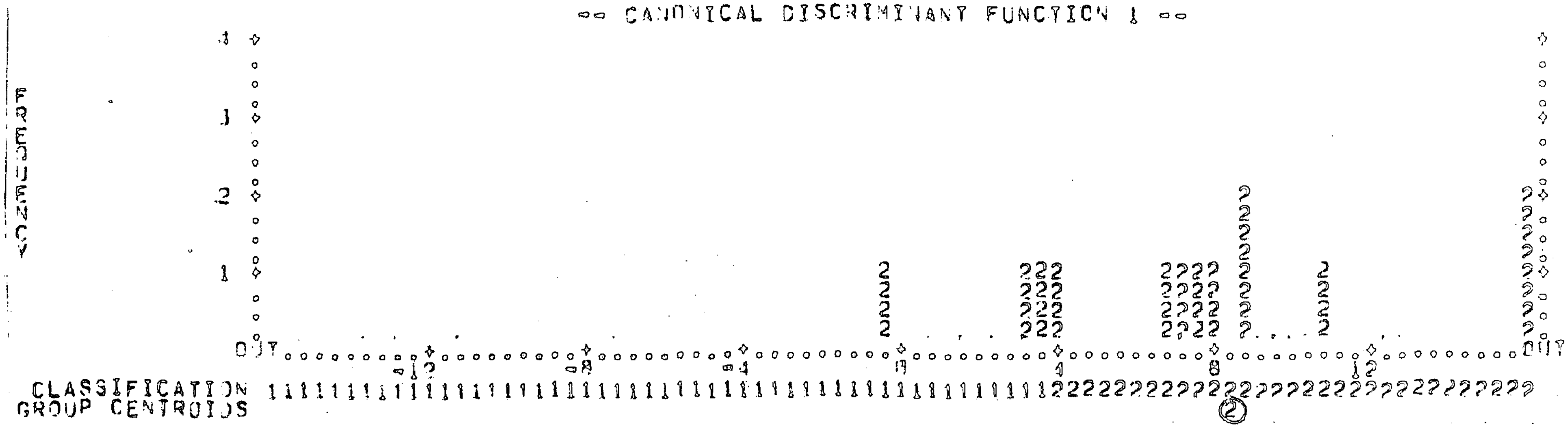


Table 6.26 Standardized Canonical Discriminant Functions

VARIABLES	FUNCTION 1
Bizygomatic Diameter	-10.80563
Nasal Breadth	10.65577
Nasal Breadth Index	8.45870
Columella Length	2.73260
Left Eye Fissure Width	2.42117
Nasal Columella Length Index	2.38049
Right Eye Fissure Width	- 2.23115
Whole Upper Lip Vertical Index	1.74540
Height of Forehead	- 1.31021
Height of Upper Face	- 1.14198
Lateral Proportion Index I	- 0.96511
Nasal Base Angle	- 0.90817
Lower Facial Height Vertical Index	0.76946
Right Eye Fissure Height	0.72059
Nasal Angle	- 0.48625

Table 6.27 Classification Results

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP	
		1	2
GROUP 1	44	41 93.2%	3 6.8%
GROUP 2	13	3 23.1%	10 76.9%

Percentage of "Grouped" cases correctly classified = 89.47%

GROUP 1 = HEHE FA

Group 2 = TUTSI FA

Table 6.28 Mann - Whitney U Test Significant Variables

NEGB MA V RGB MA		NEGB FA V RGB FA		NEGB MA V NEGB FA		RGB MA V RGB FA	
Sig. At 5% level	Sig. At 1% level	Sig. At 5% level	Sig. At 1% level	Sig. At 5% level	Sig. At 1% level	Sig. At 5% level	Sig. At 1% level
Ht.of Upp.Face	Upp.Face Height	Mouth Width	Hght.of Forehead	Bizygo. Diameter	Biaural Breadth	Rght.Eye Fiss.Ht.	Bizygo. Diameter
Eye Fiss Index	Tot.Lip Height	Tot.Lip Height	Columell Length	Biocculer Diameter	Nasal Breadth	Rght.Eye Fiss.Wth	Biaural Breadth
Lat.Prop Ind.III	Rt.Eye Fiss.Ht.	Mth.Wdth Index	Lab.Vert Rel.	Columella Length	Nasal Prom.	Lab.Vert Rel.	Nasal Breadth
	Lt.Eye Fiss.Ht.	Low.Fce. Frhd.Ht. Index	Mouth Index	Low.Fce. Frhd.Ht. Index	Nasal Height	Biocc.Mth Wth.Ind.	Bioccul. Diameter
	Orb.Aur. Dist.		Mth.Nose Wth.Ind.	Lat.Prop. Ind.I	Vert.Ht of Lower Face	Upp.-Low Face Ht. Index	Mouth Width
	Aur.Chin Dist.		Bioc.Mth Wth.Ind.	Nasal Prom.Ind.	Aur.Chin Dist.	Nas.Ht. Prom.Ind	Left Eye Fiss.Ht.
	Mouth Index		Nasal Col Lgth.Ind		Hght.of Face	Low.Faci Ht.Vert. Index	Left Eye Fiss.Wth
	Lat.Prop Ind.II				Lat.Prop Ind.II	Lat.Prop Ind. I	Nasal Prom.
	Gen.Faci Size Fac				Gen.Faci Size Fac	Nas.Prom Index	Nas.Brid Dist.
							Nasal Height
							Ht.of Whle.Upp. Lip
							Vert.Ht. of Lower Face
							Frhead. Height
							Hght.of Upp.Face
							Orb.Aur. Dist.
							Aur.Chin Dist.
							Hght.of Face
							Upp.Lip Angle
							Frontal Rec.Ang.
							Ear.Protr Index
							Gen.Faci. Size Fac.

cases the Rest of Great Britain males showed larger values than those from the North-East. This suggests that in absolute terms the Rest of Great Britain males' faces were larger than the males of the North-East.

6.4(b) Forehead

The comparison between North-Eastern females and the Rest of Great Britain females showed significant differences in the Lower Face-Forehead Height Index the value for the rest being larger and a highly significant difference in the Height of the Forehead, the North-Eastern females having the larger value for this measurement.

6.4(c) Eyes

In the males significant differences were shown in the Eye Fissure Index, the North-Easterners' being larger, and in the Right and Left Eye Fissure Height, the Rest of Great Britain males here having the larger values than the North-East males.

6.4(d) Ears

There were no significant differences shown in the variables concerning the ears.

6.4(e) Nose

There wer two highly significant differences (at 1 percent level) between North-East females and the Rest of Great Britain females. These were for the Nasal Columella Length Index and the Mouth - Nose Width Index. In both cases the North-East had larger values than the Rest of Great Britain.

6.4(f) Mouth and Lips

The Mouth Index was a highly significant difference for both males and females , North-East greater in both cases. The Total Lip Height was highly significantly larger for the Rest of Great Britain than the North-East, in the case of the males and significant in the females.

For the females the Mouth Width was significantly greater for the North-East sample and the Mouth Width Index was significantly greater for the Rest of Great Britain sample. Highly significant differences were shown for Upper Lip Height, Labial Vertical Relationship in the case of the males and Bioccular - Mouth Width Index in the case of the females. In all three of these measurements the Rest of Great Britain had the larger values than the North-East sample.

6.4(g) Chin

There were no significant differences shown in the variables connected with the chin.

6.4(h) Lateral Proportions

In the males the Lateral Proportion Index II showed highly significant differences, the North-East being greater, Index III showed significant differences, the Rest of England having the greater value.

6.4(i) Chi-Square Test

For the 128 comparisons made it would be expected that highly significant differences would occur by chance in 1 in 100 cases. The number shown was 16 which is significantly greater than that needed for the differences to have occured by chance alone (see Appendix 8) determined by applying the Chi-Square Test.

6.4(j) Discriminant Function Analysis

Table 6.29 shows the Discriminant Function Coefficients. Function 1 takes out 51.36% of the variance and Function 2 37.29% . Between them these two functions account for 88.65% of the variance. Using these two functions the scatterplots were made as shown in Figures 6.7 (a - e). From Figure 6.7(a) it is apparent that there are signifi-cant differences between the North-East sample and the Rest of Great Britain. In particular this shows up in the case of the male adults. The main differences shown however, are between the sexes and are dis-

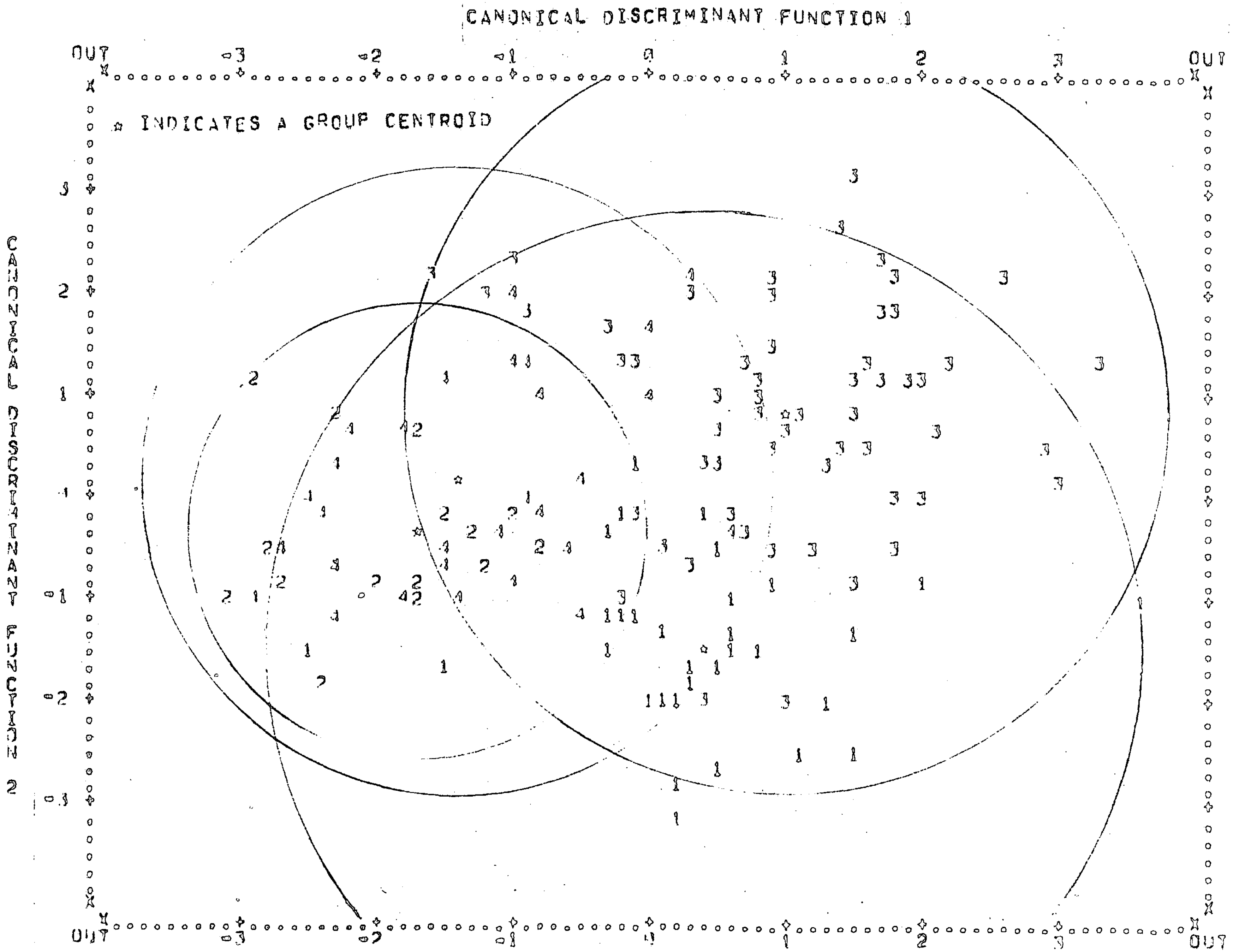


FIGURA 6.7(a) - ALL GROUPS SCATTERPLOT

1 = NEGB MA, 2 = NEGB FA, 3 = HGB MA, 4 = HGB FA.

Figure 6.7(b) - GROUP 1 = N.E.G.B. MA.

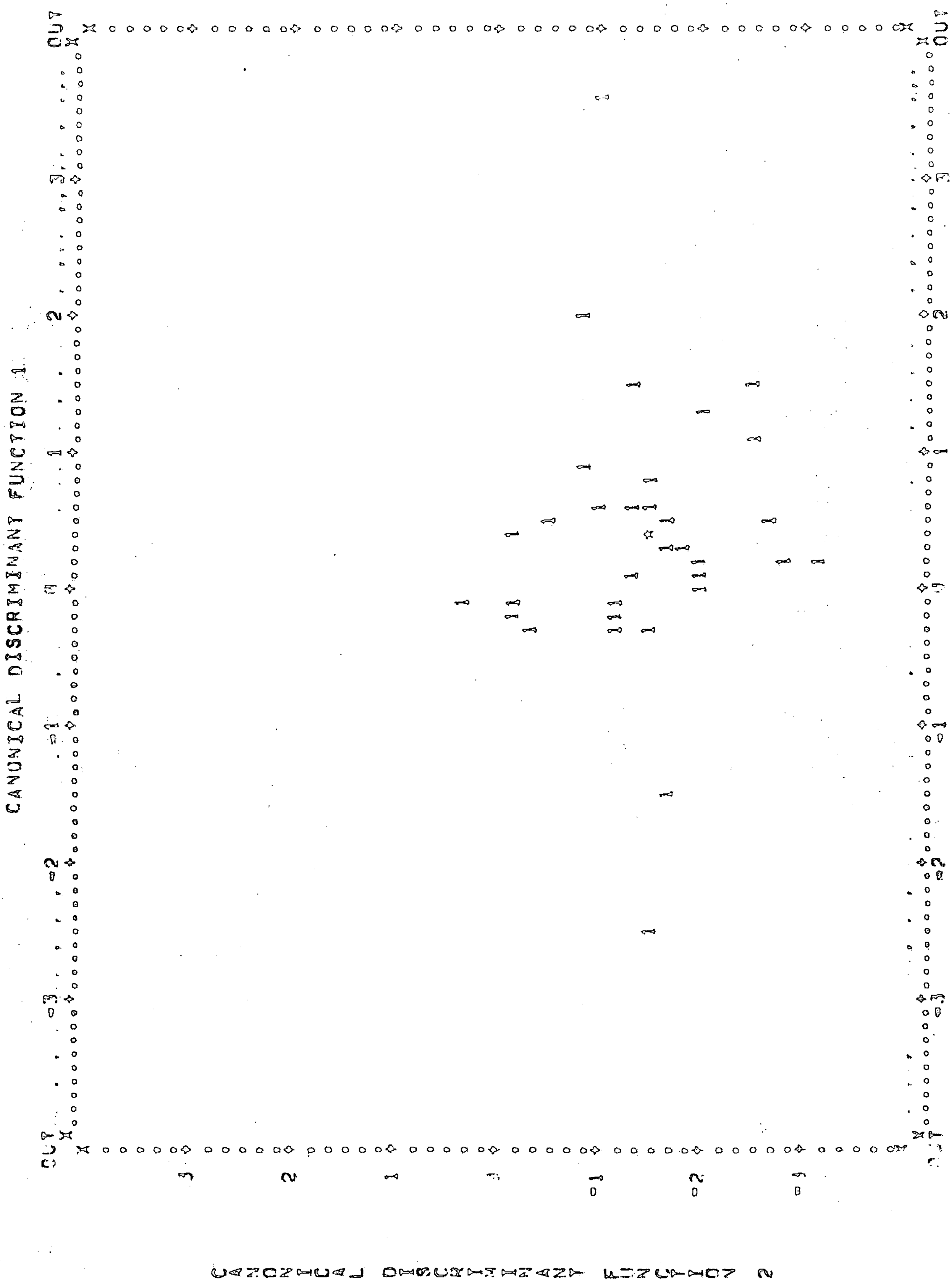


Figure 6.7(c) - GROUP 2. - N.E.G.B. FA

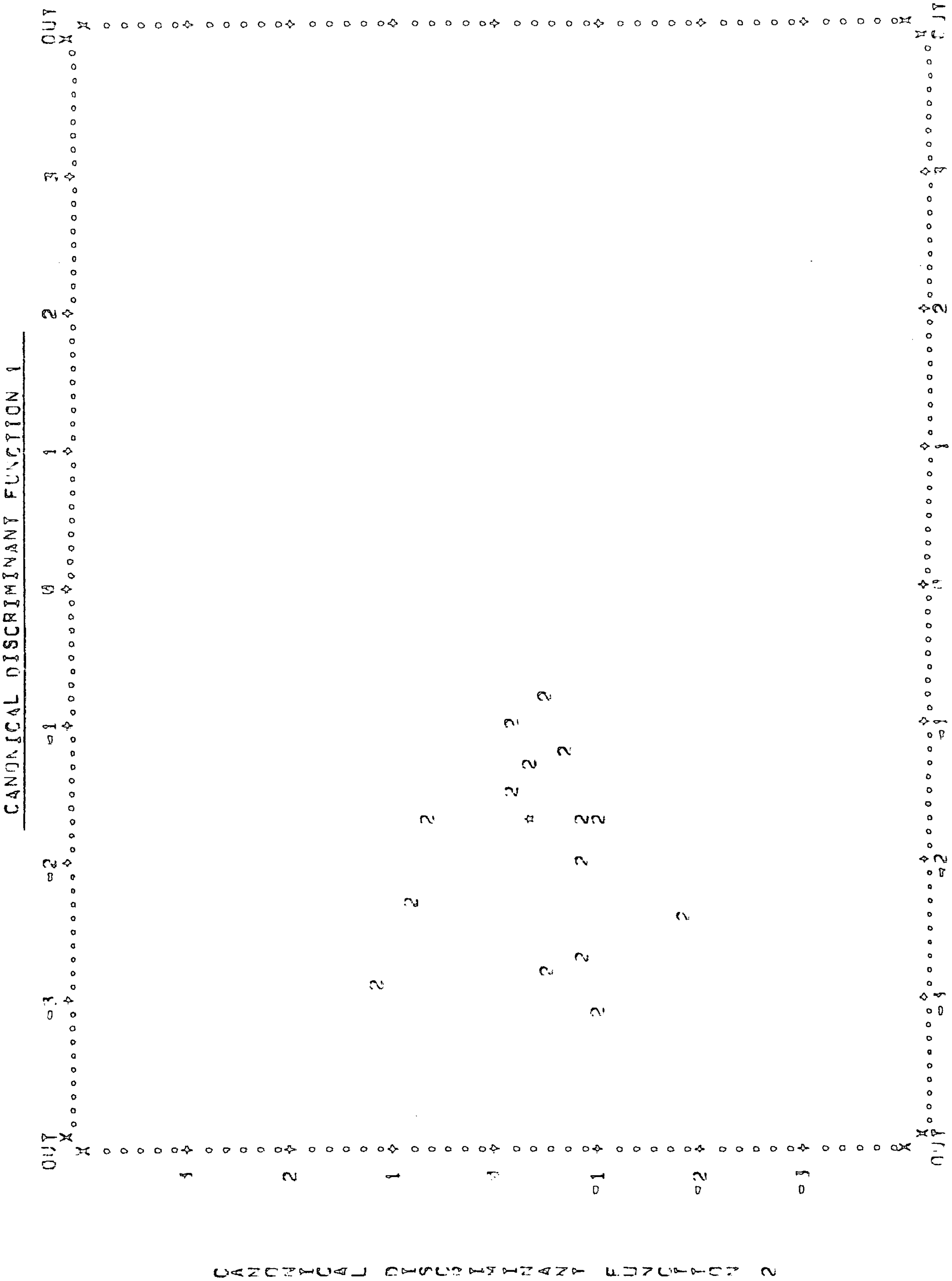


Figure 6.7(d). GROUP 3. R.G.B. MA

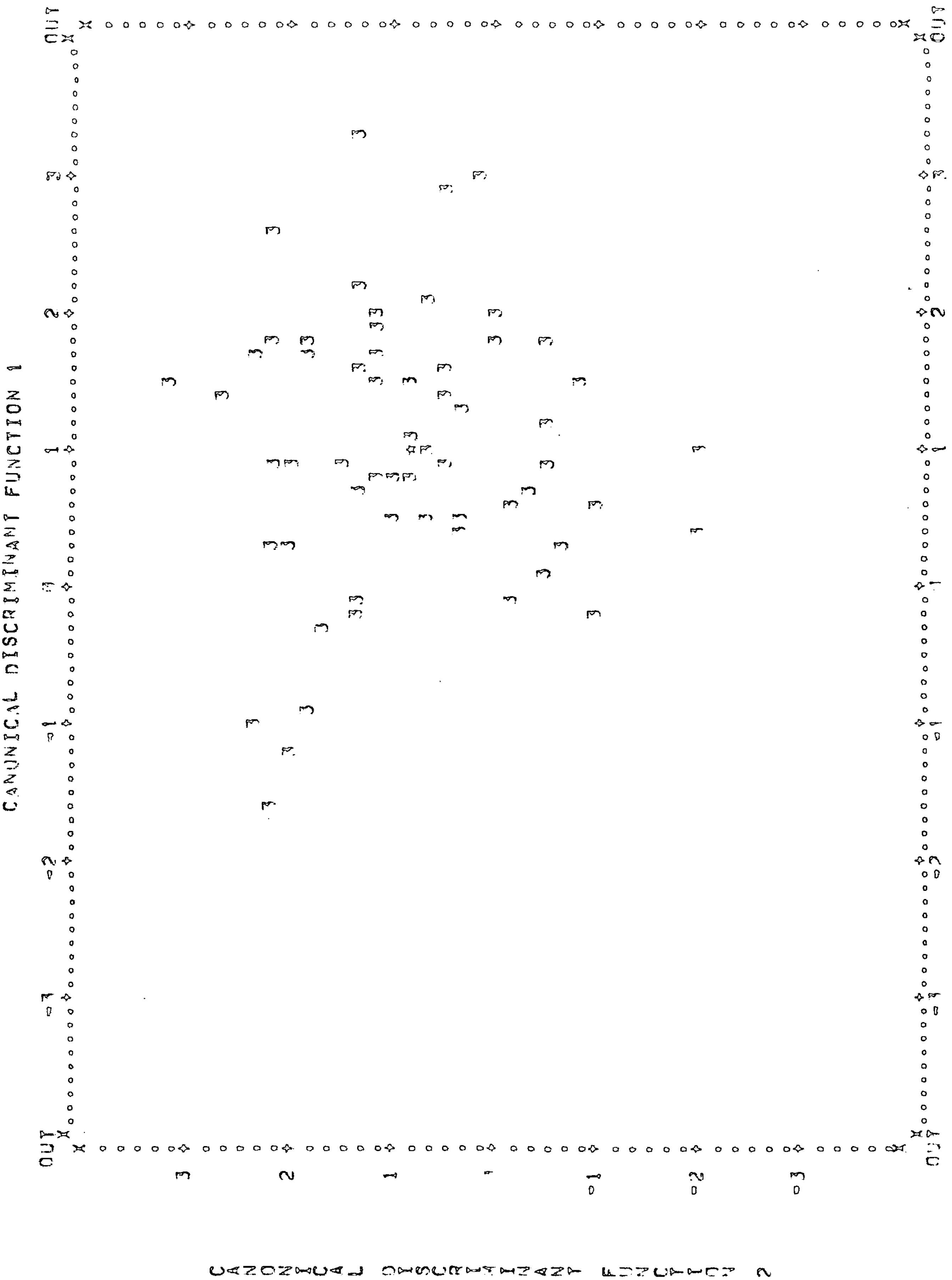


Figure 6.7(c) – GROUP 4.: R.G.B. FA

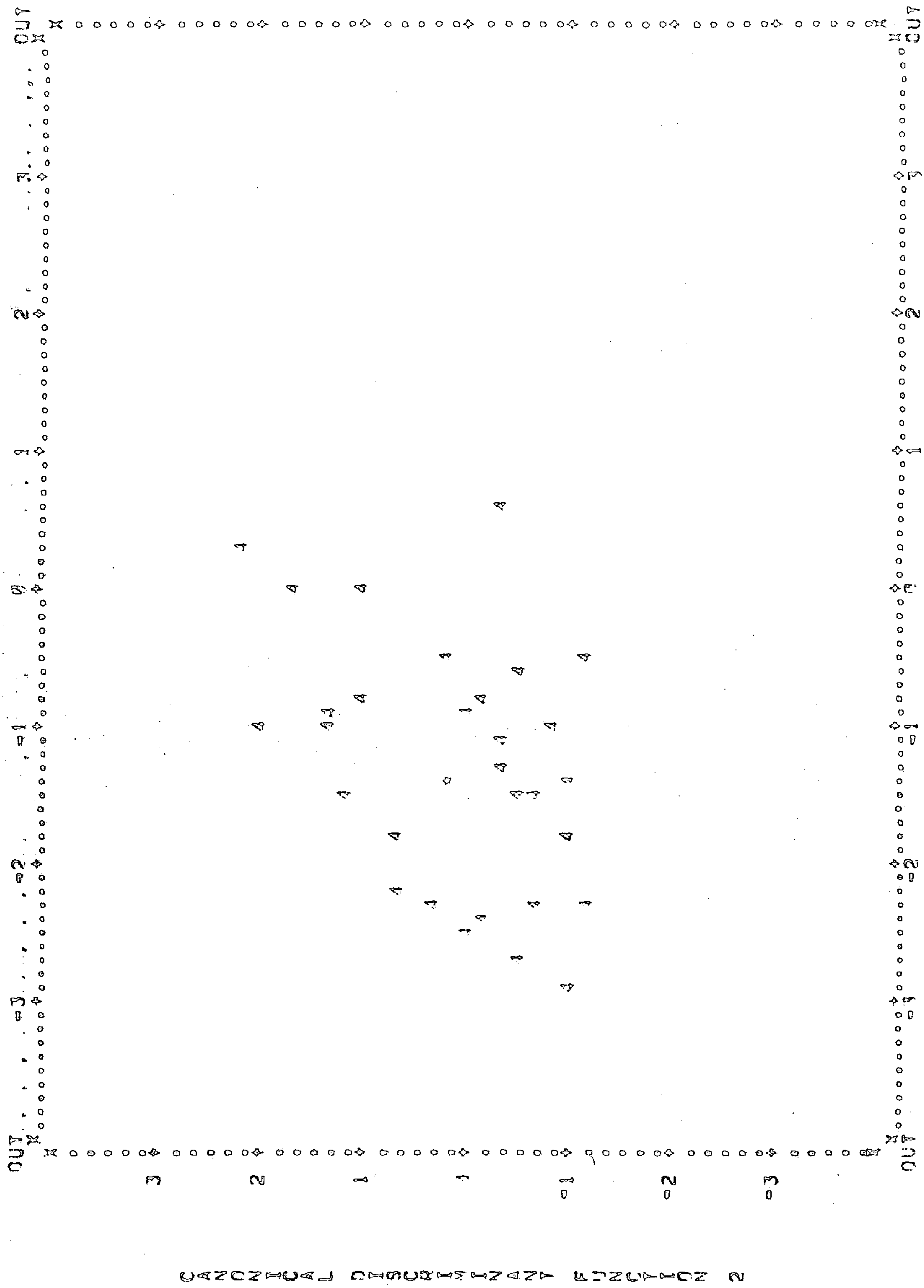


Table 6.29 Standardized Discriminant Function Coefficients

Populations:- N.E. of G.B. MA
N.E. of G.B. FA
R. of G.B. MA
R. of G.B. FA

VARIABLES	COEFFICIENTS
FUNCTION 1	
Auricle-Chin Distance	0.95370
Biaural Breadth	0.57798
Chin Angle	-0.38981
FUNCTION 2	
Inter - Occular Distance	-5.40870
Inter-Occular - Nasal Width Index	4.26769
Nasal Breadth	2.38121
Upper Face-Forehead Height Index	1.82645
Height of Forehead	1.66010
Columella Length	1.48242
Nasal Columella Length Index	1.21115
Inter-Occular Width Index	-0.89746
Right Eye Fissure Width	0.82007
Left Eye Fissure Width	-0.52254
Lateral Proportion Index II	-0.39997
Nasal Wing/Septum Relationship	0.36058
FUNCTION 3	
Nasal Index	-3.15741
Nasal Height - Prominence Index	2.87778
Nasal Prominence Index	2.34096
Vertical Height of Lower Face	1.07513
Nasal Base Angle	0.82711
Upper - Lower Facial Height Index	0.65983
Biocular - Mouth Width Index	-0.53795
Nasal Angle	0.47705
Upper Lip Angle	0.39756
Upper Lip Height	-0.39495

-cussed in Section 6.5.

Table 6.30 F Statistics and significances between pairs of groups

GROUP	1 NEGB MA	2 NEGB FA	3 RGB MA
2 NEGB FA	2.0420 0.0061		
3 RGB MA	4.0381 0.0000	4.1118 0.0000	
4 RGB FA	4.8433 0.0000	2.3476 0.0000	5.4804 0.0000

The table above shows that there are significant differences between the North-Eastern sample and the Rest of Great Britain. The greatest separation is between the male adults - 4.0381 - F value. Table 6.31 shows the results of reclassifying the grouped cases using the variables selected by the Discriminant Function Analysis. As can be seen the percentage of grouped cases correctly classified is 82.6%.

6.5 Males compared with Females

As can be seen from Table 6.32 the males are larger for every absolute measurement. All of the differences shown are highly significant apart from the Columella Length which is significant and the Nasal Bridge Distance which shows no significance. This means that in absolute terms the males faces are highly significantly larger than the females. All of the angles taken show highly significant differences apart from the Chin Angle. Of the Relationships the males have a more protracted mouth and greater +/+ values for the Nasal Wing/Septum Relationship. These differences are highly significant.

Less significance is shown in the indices with highly significant differences being shown in eleven out of the thirty variables (see Tables 6.35 and 6.36). No Discriminant Function Analysis has been carried out here because it has been carried out in Section 6.2 (see Figure 6.3 and Table 6.7).

The trends described above are not only shown for the population as a whole but also by males and females throughout the smaller populations. Figure 6.3a shows that the males and females of Great Britain can be determined between. The measurements and indices selected for Function 1 alone in this case (see Table 6.7) show up in the overall male v female analysis with the exception of Chin Angle. The North-East of Great Britain and Rest of Great Britain samples can be separated using the variables shown in Table 6.29. The greatest separation shown, however, is between the males and females in each case. See Figure 6.7a. The same trends of variables in Functions 1 and 2 are shown here.

Hehe male and female can also be separated out (see Figure 6.8) using the variables shown in Table 6.42 . Note that size differences are not so significant in the Hehe (see Table 6.37).

From the four sets of variables used for discriminating the females and males in Tanzania, Great Britain, North-East of Great Britain,

Table 6.31 Classification Results

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP			
		1	2	3	4
GROUP 1	33	27 81.8%	2 6.1%	3 9.1%	1 3.0%
GROUP 2	16	0 0.0%	13 81.3%	1 6.3%	2 12.5%
GROUP 3	61	8 13.1%	1 1.6%	49 80.3%	3 4.9%
GROUP 4	34	0 0.0%	1 2.9%	3 8.8%	30 88.2%

Percentage of "Grouped" cases correctly classified = 82.6%

GROUP 1 = N.E.G.B. MA

GROUP 2 = N.E.G.B. FA

GROUP 3 = R.G.B. MA

GROUP 4 = R.G.B. FA

Table 6.32 Absolute Measurements

VARIABLES	MEANS AND STANDARD DEVIATIONS		SIG. LEVEL
	ALL MA n= 289	ALL FA n= 130	ALL MA v ALL FA
Bizygomatic Diameter	153.806 ± 12.923	141.731 ± 10.944	1%
Biaural Breadth	183.291 ± 13.806	168.578 ± 10.858	1%
Nasal Breadth	49.827 ± 8.427	42.677 ± 6.993	1%
Inter-Occular Distance	38.360 ± 6.093	35.385 ± 5.818	1%
Bioccular Diameter	108.761 ± 11.151	99.962 ± 9.202	1%
Mouth Width	68.619 ± 10.603	58.469 ± 7.811	1%
Upper Lip Height	13.029 ± 4.982	10.097 ± 4.175	1%
Lower Lip Height	14.751 ± 4.107	12.637 ± 3.630	1%
Total Lip Height	27.780 ± 8.583	22.743 ± 7.426	1%
Right Eye Fissure Height	11.505 ± 2.406	10.228 ± 2.032	1%
Left Eye Fissure Height	11.463 ± 2.465	10.244 ± 2.192	1%
Right Eye Fissure Width	34.121 ± 3.935	32.054 ± 3.038	1%
Left Eye Fissure Width	34.574 ± 3.889	32.162 ± 2.828	1%
Nasal Prominence	30.007 ± 5.146	26.482 ± 4.249	1%
Nasal Bridge Distance	15.249 ± 5.206	14.209 ± 4.550	-
Nasal Height	51.528 ± 6.959	47.287 ± 5.602	1%
Height of Whole Upper Lip	24.235 ± 3.784	21.810 ± 3.447	1%
Vertical Height of Lower Face	76.723 ± 9.608	67.395 ± 6.805	1%
Height of Forehead	61.110 ± 10.330	56.831 ± 8.818	1%
Height of Upper Face	75.417 ± 9.519	68.477 ± 5.855	1%
Orbit-Auricle Distance	90.617 ± 10.469	81.344 ± 6.387	1%
Auriclo-Chin Distance	150.512 ± 18.877	131.727 ± 11.425	1%
Height of Face	129.405 ± 14.105	115.752 ± 8.627	1%
Columella Length	9.104 ± 2.890	8.372 ± 2.162	5%

Table 6.33 Angles

VARIABLES	MEANS AND STANDARD DEVIATIONS		SIG. LEVEL
	ALL MA n= 373	ALL FA n= 152	ALL MA v ALL FA
Nasal Angle	59.166 ± 5.702	60.836 ± 4.924	1%
Nasal Base Angle	8.359 ± 5.848	6.099 ± 4.843	1%
Upper Lip Angle	21.504 ± 15.125	14.237 ±18.139	1%
Chin Angle	- 10.298 ± 5.412	- 9.671 ± 5.316	-
Frontal Rec.Angle	74.159 ± 6.115	77.141 ± 6.174	1%

Table 6.34 Mann -Whitney U Test Results - Relationships

VARIABLES	PERCENTAGE FREQUENCY		SIG. LEVEL
	ALL MA n= 373	ALL FA n= 153	ALL MA v ALL FA
NASAL WING -SEPTUM REL.			1%
+/+	82.6	69.9	
+/-	5.4	11.1	
-/+	0.8	0.0	
+/0	9.7	17.6	
0/+	1.3	1.3	
-/0	0.3	0.0	
FRONTAL			-
Protraction	57.9	65.4	
Retraction	41.0	26.1	
Vertical	1.1	8.5	
NASAL			-
Protraction	20.4	15.7	
Retraction	78.0	81.7	
Vertical	1.6	2.6	
LABIAL			1%
Protraction	83.4	70.6	
Retraction	14.5	20.3	
Vertical	2.1	9.2	
MANDIBULAR			-
Protraction	30.4	24.8	
Retraction	62.6	68.6	
Vertical	6.7	6.5	

Table 6.35 Mann - Whitney U Test Results - Male v Female

VARIABLES	MEANS AND STANDARD DEVIATIONS		SIG. LEVEL
	ALL MA n= 371	ALL FA n= 154	ALL MA v ALL FA
Ear Protrus. Index	0.844 ± 0.043	0.844 ± 0.041	-
Mouth Index	2.607 ± 0.776	2.790 ± 0.940	-
Lip Index	0.912 ± 0.265	0.830 ± 0.232	1%
Eye Fissure Index	3.073 ± 0.534	3.195 ± 0.611	5%
Occular Index	2.844 ± 0.334	2.860 ± 0.315	-
Mouth Width Index	2.289 ± 0.268	2.440 ± 0.282	1%
Nasal Breadth Index	3.086 ± 0.405	3.314 ± 0.432	1%
Inter-Occ. Width Index	4.018 ± 0.524	4.054 ± 0.514	-
Bioccular Width Index	1.413 ± 0.084	1.417 ± 0.081	-
Mouth-Nose Width Index	1.354 ± 0.148	1.375 ± 0.157	-
Biocc-Mouth Width Index	1.619 ± 0.163	1.715 ± 0.173	1%
Inter-Occ. Nas.Wdth.Index	0.775 ± 0.103	0.824 ± 0.103	1%
Upper Face Frhd.Ht.Index	1.245 ± 0.243	1.235 ± 0.244	-
Upper-Lower Face Ht.Index	0.982 ± 0.113	1.018 ± 0.110	1%
Lower Face Frhd.Ht.Index	1.271 ± 0.225	1.221 ± 0.217	1%
Lower Face Prop. Index	3.134 ± 0.373	3.123 ± 0.365	-
Nasal Height Prom.Index	1.767 ± 0.276	1.845 ± 0.270	1%
Nasal Prom. Brdge.Index	2.250 ± 1.073	2.100 ± 0.777	-
Whole Upper Lip Vert.Ind.	2.119 ± 0.400	2.190 ± 0.456	-
Lower Facial Ht.Vert.Index	1.510 ± 0.216	1.461 ± 0.236	5%
Nasal Col. Length Index	6.400 ± 0.234	6.038 ± 1.516	-
Lat. Prop. Index I	1.648 ± 0.108	1.620 ± 0.093	1%
Lat. Prop. Index II	1.429 ± 0.130	1.422 ± 0.118	-
Lat. Prop. Index III	1.160 ± 0.100	1.145 ± 0.096	-
Nasal Prom. Lat. Index	5.174 ± 0.886	5.260 ± 1.070	-
Nasal Bridge Lat. Index	11.706 ± 6.171	11.098 ± 4.960	-

Table 6.36 Mann-Whitney U Test- Indices using both views

VARIABLES	MEANS AND STANDARD DEVIATIONS		SIG. LEVEL
	ALL MA n= 289	ALL FA n= 130	ALL MA v ALL FA
General Facial Size Factor	5.244 ± 0.509	4.703 ± 0.293	1%
Nasal Bridge Index	2.919 ± 1.008	3.051 ± 0.996	-
Nasal Prom. Index	5.750 ± 0.964	5.648 ± 1.014	-
Nasal Index	1.066 ± 0.236	1.144 ± 0.256	1%

Rest of Great Britain, and Hehe the following variables appear in Functions 1 or 2 of each Discriminant Functions Analysis:-

Eye Fissure Index
Upper Lip Angle
Lower Face - Forehead Height Index
Labial Protraction/Retraction
Lateral Proportion Index II
Inter - Occular Distance
Columella Length
Mandibular Protraction/Retraction
Columella Length Vertical Index

These appear in at least two out of three of the Discriminant Function Analyses carried out showing that it is not just size which different--iates male and female but proportions of the face, relationships and angles as well. Separating these variables into parts of the face it can be seen that two variables concern the eyes, two the mouth and two for the nose, plus one each for the Chin Lateral Proportions of the Face and Vertical Proportions of the Face.

6.6 Adults compared with Juveniles

The Hehe as a group contained the four different categories male adult, female adult, male juvenile and female juvenile.

Using these results we can extract the differences between adults and juveniles.

6.6(a) Head and size of Face

Highly significances are shown between adults and juveniles, both male and female, for Bizygomatic Diameter, Height of Upper Face, Auricle-Chin Distance, Vertical Height of Lower Face and the General Facial Size Factor Index. In all cases the adult is larger than the juvenile. For the Orbit-Auricle Distance the adults values are again larger but significance is shown only at the 5% level for the males.

6.6(b) Forehead

For the Height of Forehead significance is shown between female adults and juveniles the adults being larger. The Frontal Re--cession Angle shows a highly significant difference for males and a significant difference for females. The Frontal Recession Angle is greater in the juveniles showing their forehead does not slope as much as the adults. From Table 6.40, the Upper Face - Forehead Height Index shows significance at 5% level at 1% levels for males and females re--spectively. The Lower Face - Forehead Height Index and the Frontal Vertical Relationships both show no significant differences between adult and juvenile .

6.6(c) Eyes

For the variables associated with the eyes only the Bioccular Distance and Inter-Occular Diameter show significant differences at the 5% level all other variables show no significant differences between adults and juveniles.

6.6(d) Ears

The Biaural Breadth shows no significant differences between adults and juveniles while the Ear Protrusion Index shows a highly sig--nificant difference between female adults and juveniles. The adult being larger or ears protruding more.

6.6(e) Nose

The adults and juveniles show highly significant differences for Nasal Breadth, Nasal Prominence and Nasal Height. All are, of course, absolute measurements and adults are larger than juveniles. Columella Length show a highly significant difference for the females and Nasal Bridge Distance shows a significant difference for the females. Adults again are larger but males show no significant difference for these two variables. From Table 6.38 neither the Nasal Angle or Nasal Base Angle

Table 6.37 Mann - Whitney U Test Results - Hehe

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST			
	HEHE MA n= 66	HEHE FA n= 45	HEHE MJ n= 28	HEHE FJ n= 28	MA v FA	MA v MJ	FA v FJ	MJ v FJ
Bizygomatic Diameter	149.894 ± 8.889	149.222 ±11.522	144.321 ± 8.327	141.750 ± 6.473	-	1%	1%	-
Biaural Breadth	176.000 ±11.003	171.909 ±11.503	171.464 ± 8.654	170.607 ±10.333	5%	-	-	-
Nasal Breadth	52.409 ± 4.664	50.422 ± 4.770	47.857 ± 5.772	46.571 ± 3.392	5%	1%	1%	-
Int.-Occular Distance	39.924 ± 3.860	40.644 ± 4.432	39.071 ± 3.453	38.429 ± 4.086	-	-	5%	-
Bioccular Diameter	108.803 ± 6.576	108.667 ± 8.586	105.857 ± 6.542	104.786 ± 8.324	-	5%	5%	-
Mouth Width	70.400 ± 6.921	65.658 ± 6.019	64.269 ± 5.088	62.179 ± 4.603	1%	1%	1%	-
Upper Lip Height	14.762 ± 2.312	14.023 ± 2.415	13.407 ± 2.005	13.786 ± 2.515	-	5%	-	-
Lower Lip Height	15.651 ± 2.695	15.488 ± 2.463	14.370 ± 2.467	15.143 ± 2.384	-	-	-	-
Total Lip Height	30.349 ± 4.178	29.558 ± 3.954	27.741 ± 3.493	28.714 ± 4.215	-	5%	-	-
Right Eye Fissure Ht.	10.585 ± 1.580	11.156 ± 2.174	9.786 ± 1.500	11.556 ± 1.783	-	5%	-	1%
Left Eye Fissure Ht.	10.446 ± 1.436	11.333 ± 2.132	10.464 ± 1.710	11.148 ± 1.610	5%	-	-	-
Right Eye Fissure Wth.	33.015 ± 3.208	33.222 ± 3.723	32.286 ± 2.432	32.214 ± 3.489	-	-	-	-
Left Eye Fissure Wth.	33.333 ± 3.279	32.778 ± 3.490	32.000 ± 2.309	32.964 ± 3.459	-	5%	-	-
Nasal Prominence	25.227 ± 4.895	23.133 ± 2.873	20.133 ± 3.616	20.894 ± 2.845	1%	1%	1%	-
Nasal Bridge Dist.	11.538 ± 4.793	12.391 ± 4.318	9.536 ± 3.543	10.172 ± 2.941	-	-	5%	-
Nasal Height	45.742 ± 5.650	44.500 ± 5.154	42.107 ± 4.984	41.448 ± 5.494	-	1%	1%	-
Height of Whole Upp.Lip	23.530 ± 3.212	24.022 ± 2.785	22.929 ± 3.321	23.310 ± 2.792	-	-	-	-
Vert.Ht. of Lower Face	73.242 ± 8.851	72.239 ± 6.812	66.607 ± 4.748	67.759 ± 6.045	-	1%	1%	-
Height of Forehead	52.561 ± 9.715	55.800 ± 7.721	54.714 ± 6.235	59.552 ± 6.367	5%	-	5%	5%
Height of Upper Face	71.591 ± 7.054	70.804 ± 5.636	66.500 ± 5.770	67.621 ± 5.010	-	1%	5%	-
Orbit-Aur. Distance	87.354 ± 7.134	85.711 ± 5.546	83.857 ± 4.964	84.414 ± 5.641	-	5%	-	-
Auricle-Chin Dist.	142.348 ±12.042	141.356 ± 7.532	132.821 ± 9.623	133.379 ± 9.071	-	1%	1%	-
Height of Face	118.682 ±11.678	116.696 ± 9.357	110.000 ± 8.055	109.828 ± 8.929	-	1%	1%	-
Columella Length	7.788 ± 2.509	7.826 ± 1.651	6.893 ± 1.988	6.759 ± 1.845	-	-	1%	-

show any significant differences between adult and juvenile. The Nasal Bridge Index and Nasal Index show no significant differences for adults and juveniles but the Nasal Prominence Index shows a highly significant difference for the male adults compared with male juveniles (see Table 6.41). The same is shown for the Nasal Bridge Index and Interoccular-Nasal Width Index with high significance occuring only in the male adult - juvenile comparison. No other of the indices for the nasal area show any significance apart from the Nasal Prominence Lateral Index which shows a highly significant difference between male adults and juveniles and a significant difference between female adults and juveniles.

Table 6.38

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST			
	HEHE MA n= 112	HEHE FA n= 62	HEHE MJ n= 31	HEHE FJ n= 31	MA v FA	MA v MJ	FA v FJ	MJ v FJ
Nasal Angle	59.089 ± 5.850	58.903 ± 4.891	58.645 ± 4.409	60.000 ± 4.872	-	-	-	-
Nasal Base Angle	8.955 ± 5.579	8.952 ± 4.389	9.839 ± 3.839	8.613 ± 3.353	-	-	-	-
Upper Lip	27.205 ± 9.475	27.419 ± 9.659	31.290 ± 7.656	32.387 ± 9.625	-	5%	5%	-
Chin Angle	- 9.527 ± 6.033	- 7.919 ± 4.740	- 9.581 ± 5.163	-10.613 ± 4.161	-	-	-	-
Frontal	73.723 ± 5.510	74.742 ± 5.848	77.355 ± 4.215	76.613 ± 4.522	-	1%	5%	-

6.6(f) Mouth and Lips

The only variables which show any significant difference (at 5% level) for the Labial Region are the Upper Lip Angle, for both male and female, Upper Lip Height and Total Lip Height, male only, and Bi-occular Mouth Width Index, female only.

6.6(g) Chin

For the Chin Region two variables give significant differences

Table 6.39 Relationships (Hehe)

VARIABLES	PERCENTAGE FREQUENCIES				SIGNIFICANCE LEVEL FROM MANN - WHITNEY U TEST			
	HEHE MA n= 112	HEHE FA n= 63	HEHE MJ n= 31	HEHE FJ n= 31	MA v FA	MA v MJ	FA v FJ	MJ v FJ
Nasal Wing Septum Rel					-	-	5%	5%
+/+	81.3	76.2	74.2	96.8				
+/-	5.4	12.7	9.7	0.0				
-/+	1.8	0.0	0.0	0.0				
+/0	7.1	7.9	9.7	3.2				
0/+	3.6	3.2	6.3	0.0				
-/0	0.9	0.0	0.0	0.0				
FRONTAL					-	-	-	-
Protraction	67.9	68.3	77.4	74.2				
Retraction	32.1	30.2	19.4	22.6				
Vertical	0.0	1.6	3.2	3.2				
NASAL					-	-	-	-
Protraction	28.6	31.7	45.2	22.6				
Retraction	70.5	63.5	41.9	67.7				
Vertical	0.9	4.8	12.9	9.7				
LABIAL					-	-	-	-
Protraction	96.4	100.0	100.0	100.0				
Retraction	3.6	0.0	0.0	0.0				
Vertical	0.0	0.0	0.0	0.0				
MANDIBULAR					-	-	5%	-
Protraction	40.2	41.3	35.5	25.8				
Retraction	50.0	54.0	61.3	48.4				
Vertical	9.8	4.8	3.2	25.8				

Table 6.40 Mann-Whitney U Test Results - Hehe - Indices

VARIABLES	MEAN AND STANDARD DEVIATIONS				LEVELS OF SIGNICICANCE FROM MANN-WHITNEY U TEST			
	HEHE MA n= 112	HEHE FA n= 62	HEHE MJ n= 31	HEHE FJ n= 31	MA v FA	MA v MJ	FA v FJ	MJ v FJ
Ear Protr. Index	0.852 ± 0.035	0.869 ± 0.041	0.841 ± 0.036	0.831 ± 0.032	1%	-	1%	-
Mouth Index	2.359 ± 0.326	2.249 ± 0.370	2.346 ± 0.356	2.200 ± 0.315	5%	-	-	-
Lip Index	0.982 ± 0.177	0.939 ± 0.189	0.958 ± 0.205	0.917 ± 0.160	-	-	-	-
Eye Fissure Index	3.139 ± 0.367	2.988 ± 0.463	3.180 ± 0.440	2.917 ± 0.352	1%	-	-	5%
Occular Index	2.772 ± 0.279	2.734 ± 0.262	2.714 ± 0.183	2.779 ± 0.321	-	-	-	-
Mouth Width Index	2.203 ± 0.214	2.295 ± 0.257	2.264 ± 0.184	2.284 ± 0.175	5%	-	-	-
Nasal Breadth Index	2.859 ± 0.214	2.965 ± 0.203	3.043 ± 0.289	3.047 ± 0.186	1%	1%	-	-
Inter-Occular Width Index	3.816 ± 0.381	3.763 ± 0.363	3.703 ± 0.270	3.759 ± 0.386	-	-	-	-
Bioccular Width Index	1.378 ± 0.063	1.379 ± 0.076	1.365 ± 0.048	1.356 ± 0.075	-	-	-	-
Mouth-Nose Width Index	1.306 ± 0.135	1.303 ± 0.134	1.337 ± 0.145	1.338 ± 0.089	-	-	-	-
Biocc.-Mouth Width Index	1.604 ± 0.161	1.666 ± 0.180	1.665 ± 0.155	1.689 ± 0.163	5%	-	5%	-
Inter-Occular Nasal Wth.Index	0.756 ± 0.093	0.795 ± 0.091	0.825 ± 0.086	0.818 ± 0.084	1%	1%	-	-
Upper Face-Frhd.Ht.Index	1.323 ± 0.295	1.290 ± 0.260	1.237 ± 0.199	1.139 ± 0.133	-	5%	1%	-
Upper-Lower Face Ht.Index	0.978 ± 0.112	0.987 ± 0.099	1.002 ± 0.094	1.000 ± 0.110	-	-	-	-
Lower Face-Frhd.Ht.Index	1.355 ± 0.275	1.309 ± 0.226	1.233 ± 0.143	1.145 ± 0.134	-	5%	1%	5%
Lower Face Prop.Index	3.049 ± 0.345	3.052 ± 0.338	2.452 ± 0.375	2.922 ± 0.292	-	-	5%	-
Nasal Height Prom.Index	1.848 ± 0.327	1.959 ± 0.291	2.093 ± 0.323	2.034 ± 0.309	5%	1%	-	-
Nasal Prom. Bridge Index	2.510 ± 1.307	2.220 ± 0.927	2.548 ± 1.768	2.159 ± 0.658	-	-	-	-
Whole Upp. Lip Vert.Index	1.964 ± 0.317	1.912 ± 0.262	1.875 ± 0.297	1.796 ± 0.260	-	-	-	-
Lower Facial Ht.Vert.Index	1.578 ± 0.212	1.611 ± 0.194	1.592 ± 0.183	1.646 ± 0.186	-	-	-	-
Nasal Col. Length Index	6.637 ± 2.220	6.066 ± 1.465	6.499 ± 1.779	6.561 ± 1.783	-	-	-	-

Table 6.40 Mann-Whitney U Test Results - Hehe - Indices (continued)

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST			
	HEHE MA n= 112	HEHE FA n= 62	HEHE MJ n= 31	HEHE FJ n= 31	MA v FA	MA v MJ	FA v FJ	MJ v FJ
Lat. Prop Index I	1.609 ± 0.100	1.643 ± 0.072	1.581 ± 0.077	1.586 ± 0.102	5%	-	1%	-
Lat. Prop. Index II	1.363 ± 0.103	1.370 ± 0.083	1.311 ± 0.086	1.315 ± 0.123	-	1%	1%	-
Lat. Prop. Index III	1.187 ± 0.103	1.203 ± 0.072	1.210 ± 0.087	1.211 ± 0.082	-	-	-	-
Nasal Prom Lateral Index	5.602 ± 0.825	6.124 ± 0.706	6.619 ± 1.130	6.513 ± 0.831	1%	1%	5%	-
Nasal Bridge Lateral Index	14.098 ± 8.037	13.485 ± 5.527	16.677 ±11.709	13.931 ± 3.995	-	-	-	-

Table 6.41 Mann-Whitney U Test Results - Indices using both views for Hehe

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE FROM MANN-WHITNEY U TEST			
	HEHE MA n= 66	HEHE FA n= 45	HEHE MJ n= 28	HEHE FJ n= 28	MA v FA	MA v MJ	FA v FJ	MJ v FJ
Gen. Facial Size Factor	4.980 ± 0.348	4.925 ± 0.274	4.710 ± 0.236	4.695 ± 0.237	-	1%	1%	-
Nasal BridgeIndex	2.308 ± 0.927	2.544 ± 0.889	2.025 ± 0.737	2.191 ± 0.623	-	-	-	-
Nasal Prom. Index	5.077 ± 0.815	4.690 ± 0.571	4.338 ± 0.636	4.439 ± 0.554	1%	1%	-	-
Nasal Index	0.878 ± 0.119	0.886 ± 0.089	0.887 ± 0.113	0.894 ± 0.115	-	-	-	-

Table 6.42 Standardized Discriminant Function Coefficients

VARIABLES	COEFFICIENTS
FUNCTION 1	
Lower Face-Forehead Height Index	-0.56998
Eye Fissure Index	-0.45142
Uppor-Lower Facial Height Index	0.39794
Mandibular Protraction/Retraction	0.37788
Labial Protraction/Retraction	-0.21694
FUNCTION 2	
Ear Protrusion Index	0.82752
Lateral Proportion Index I	0.63042
Upper Lip Angle	-0.43867
FUNCTION 3	
Nasal Prominence Lateral Index	-1.28194
Nasal Height-Prominence Index	0.93415
Lower Facial Height Vertical Index	0.92947
Frontal Recession Angle	-0.54836
Nasal Columella Length Index	0.46660
Nasal Wing/Septum Relationship	-0.38711
Nasal Breadth Index	-0.32761

between female adults and juveniles, these are, the Lower Facial Propor--tion Index and the Mandibular Vertical Relationship. All other compari--sons show no significant differences.

6.6(h) Lateral Proportion

Lateral Proportion Index I shows a highly significant differ--ence between female adults and juveniles, Index II shows highly signifi--cant differences between male and female adults and juveniles, Index III shows no significant differences.

6.6(i) Chi-Square Test

40 highly significant differences are found which when the Chi-Square Test is carried out prove to be much greater than the number that could happen by chance alone (see Appendix 8).

6.6(j) Discriminant Function Analysis

Table 6.42 shows the Discriminant Function Coefficients, Function 1 accounts for 69.69% of the variance, Function 2 for 21.39% and Function 3 for 8.92%. A scatterplot was produced using Functions 1 and 2 which together account for 91.08% of total variance. From the scatterplot Figure 6.8(a) it can be seen that all of the individuals are clustered closely together but the two centroids for the adults, and the two for the juveniles are closer together and the two pairs of centroids are further apart than they are in their individual pairs. Table 6.43 shows that using the variables contained in the Functions as selected by the Discriminant Function Analysis 62.88% of the grouped cases are correct--ly classified.

6.6(k) Tutsi adults v juveniles

As can be seen from Table 6.44 there are highly significant differences produced between Tutsi male and female adults and juveniles by the following variables; Auricle-Chin distance and Vertical Height of Lower Face. In addition the females show highly significant differ-

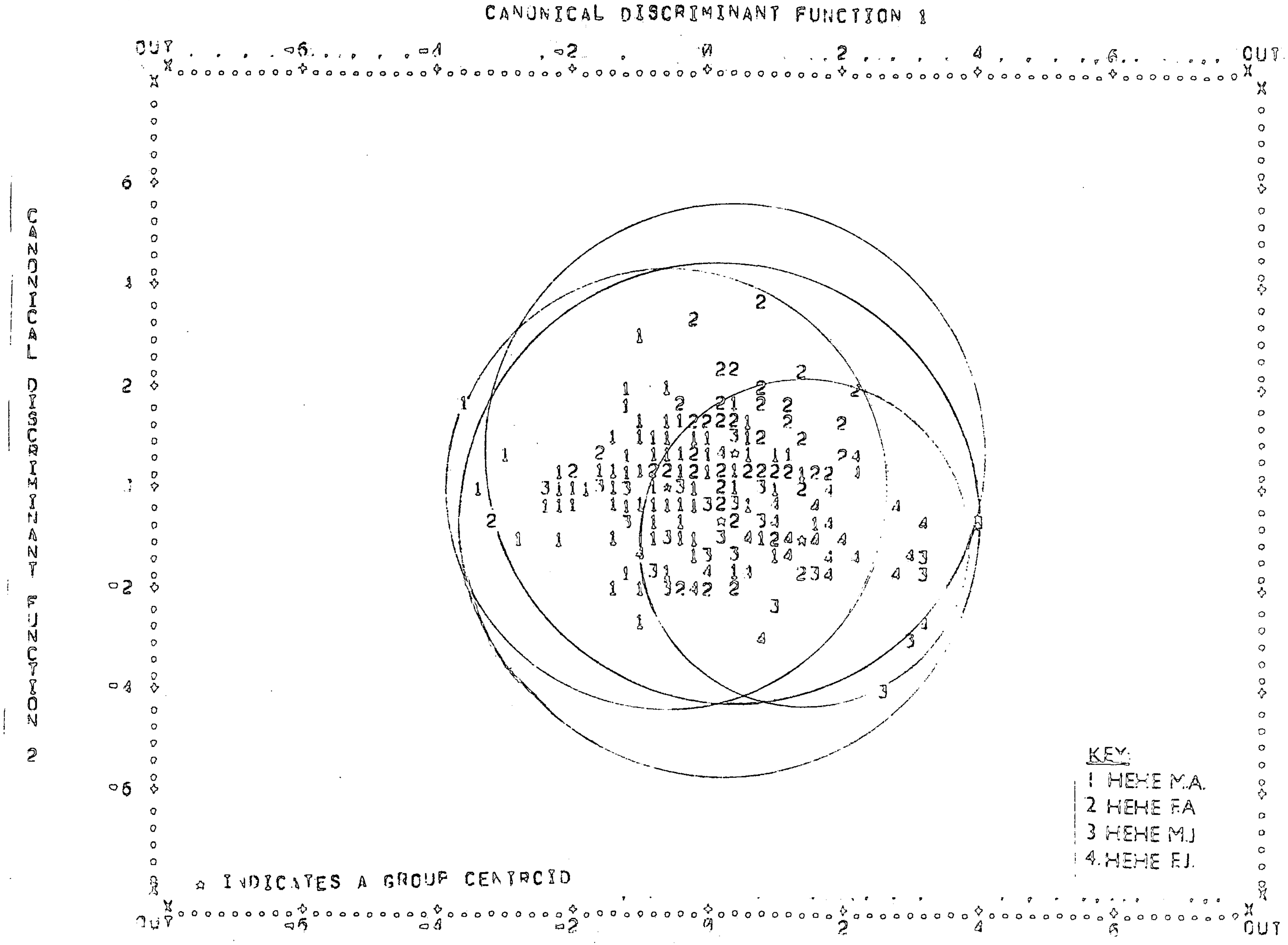


Figure 6.8(a) Scatterplot for Hehe (all categories).

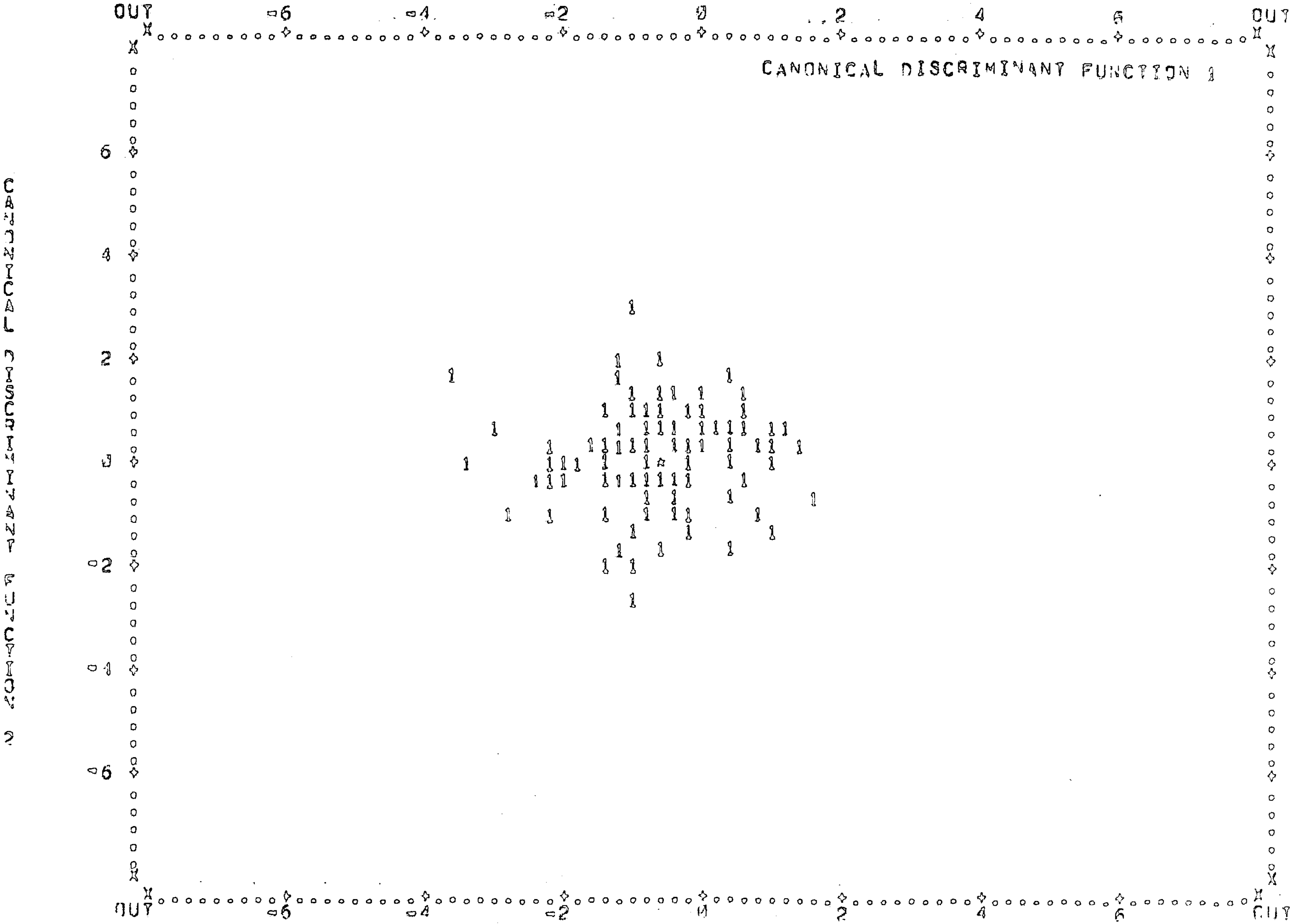


Figure 6.8(b)-Group 1 - Koho M.A.

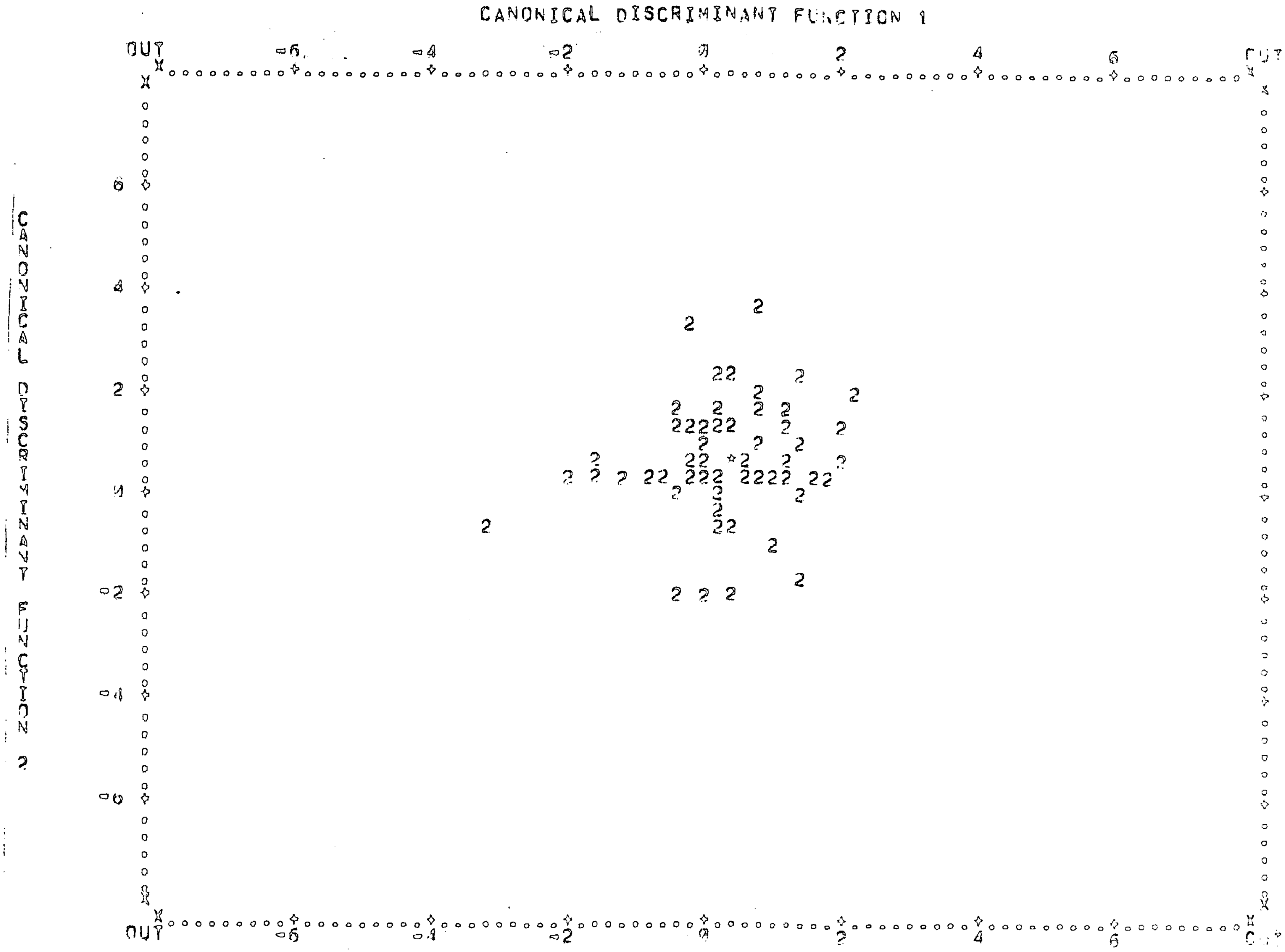

CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2

Figure 6.8(d)— Group 3 - Hehe M.J.

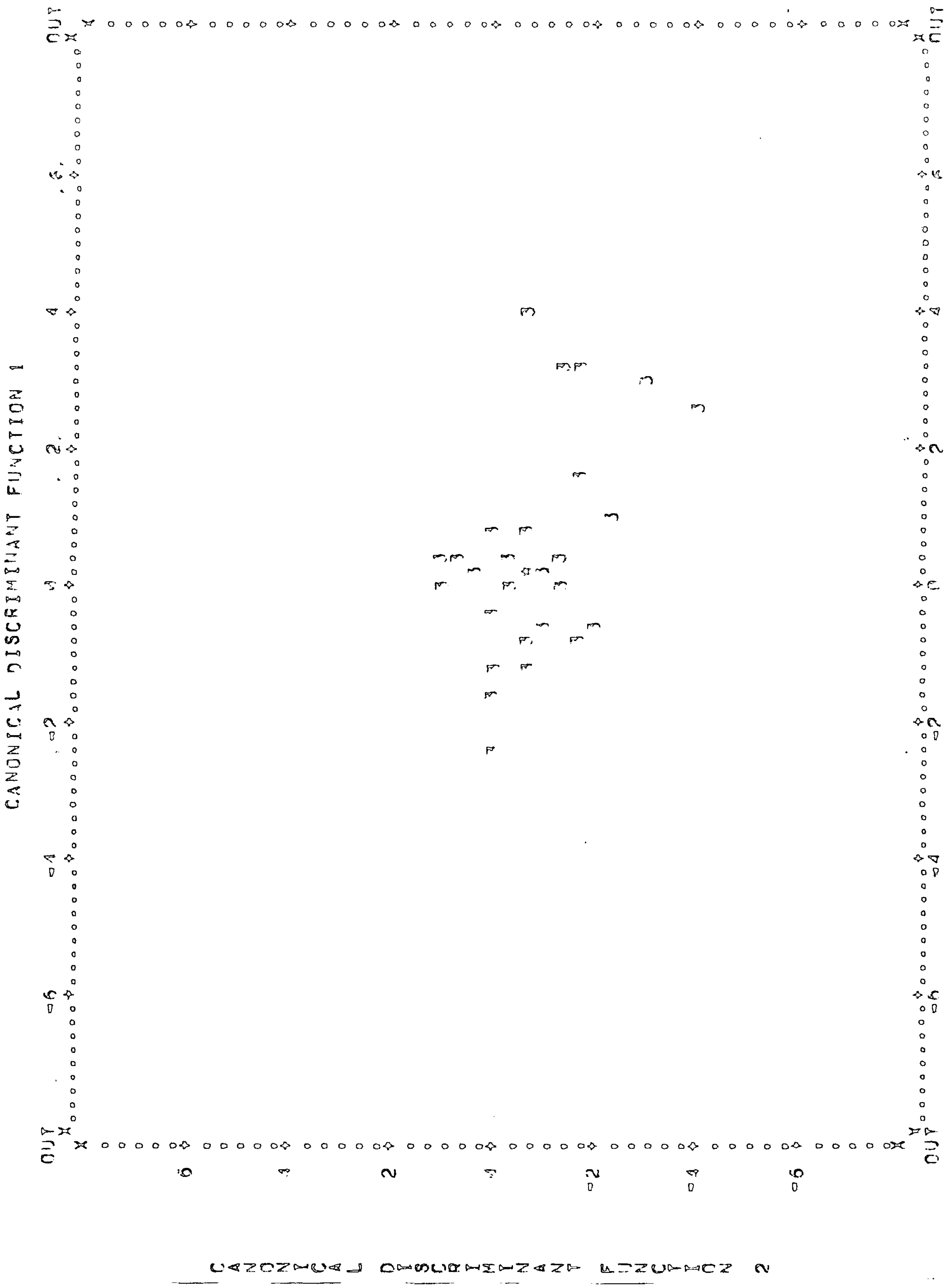


Figure 6.8(e) -- Group A : Hohe F.J.

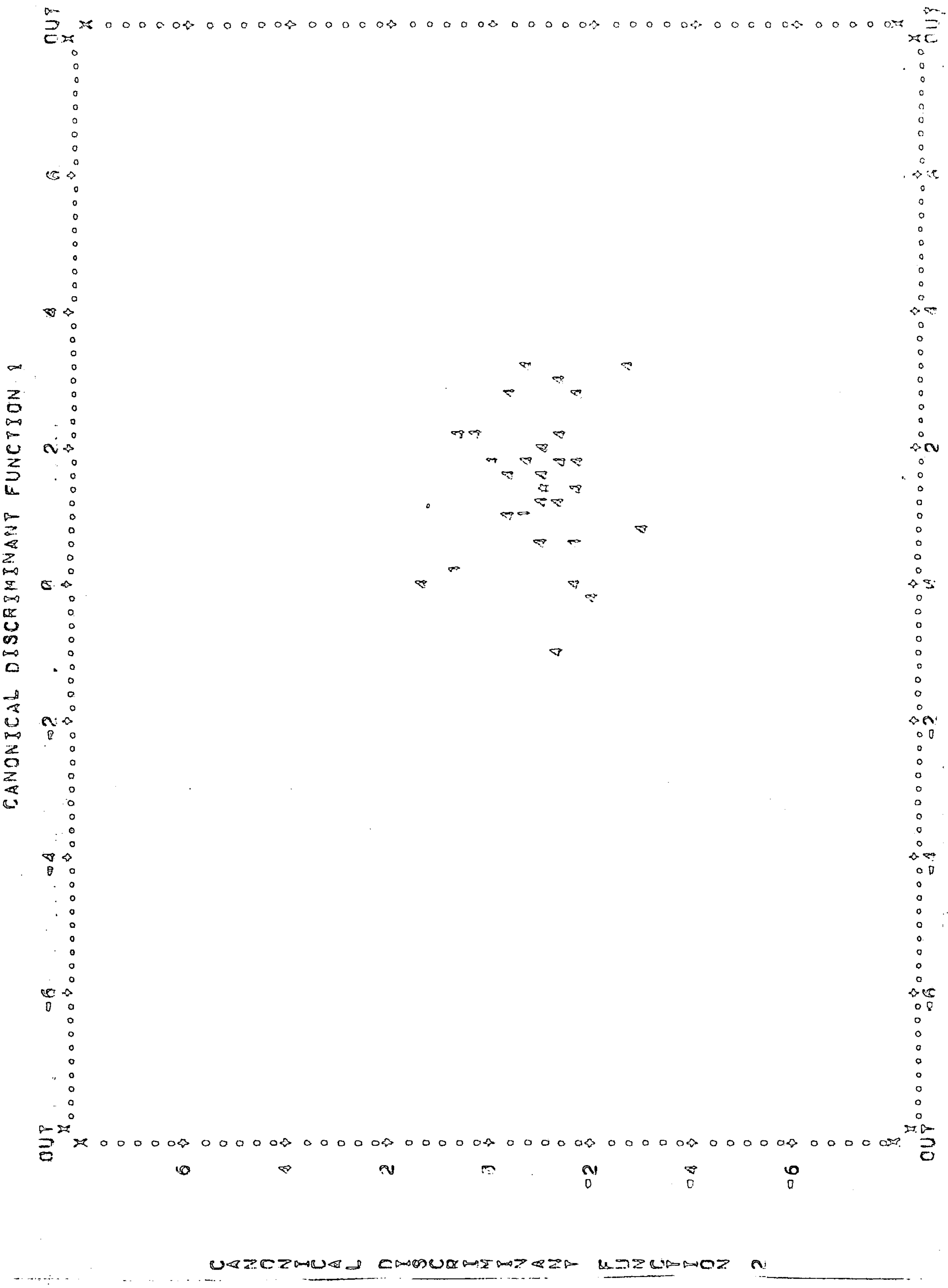


Table 6.43 Classification Results

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2	3	4
GROUP 1	108	73 67.6%	20 18.5%	11 10.2%	4 3.7%
GROUP 2	61	11 18.0%	35 57.4%	8 13.1%	7 11.5%
GROUP 3	31	4 12.9%	4 12.9%	15 48.4%	8 25.8%
GROUP 4	29	2 6.9%	2 6.9%	4 13.8%	21 72.4%

Percentage of "Grouped" cases correctly classified = 62.88%

GROUP 1 = HEHE MA

GROUP 2 = HEHE FA

GROUP 3 = HEHE MJ

GROUP 4 = HEHE FJ

Table 6.44 Significant Results of Mann-Whitney U Test for Tutsi

TUTSI MA v TUTSI MJ		TUTSI FA v TUTSI FJ		TUTSI MJ v TUTSI FJ	
Sig. At 5% level	Sig. At 1% level	Sig. At 5% level	Sig. At 1% level	Sig. At 5% level	Sig. At 1% level
Lower Lip Height	Vert.Ht. of Lower Face	Nasal Height	Bizygomatic Diameter	Bioccular Diameter	
Total Lip Height	Auricle-Chin Dist.	Lower Face Frhd.Ht.Ind.	Bioccular Diameter	Vert.Ht. of Lower Face	
Left Eye Fissure Wdth			Vert.Ht. of Lower Face	Auricle-Chin Dist.	
Ht.of Whole Upper Lip			Ht.of Upper Face	General Fac. Size Factor	
Ht.of Upper Face			Orbit-Auri. Distance		
Height of Face			Auricle-Chin Distance		
Nasal Angle			Height of Face		
Lower Face Frhd.Ht.Ind.			Gen.Facial Size Factor		
Gen.Facial Size Factor					

-ences between adults and juveniles for Bizygomatic Diameter, Biocular Diameter, Height of Upper Face, Orbit-Auricle Distance, Height of Face and General Facial Size Factor. Note these are all measures of facial size and the adults are greater.

6.7 Factor Analysis

A Factor Analysis was carried out to determine which of the variables, or sets of variables, best discriminated between individuals and facilitated partitioning into sets. As can be seen from Table 6.45 the first two factors take out over 50% of the variance whereas the last nine factors only take out 20% of the variance. Table 6.46 shows which variables contribute most to which particular factors and figure 6.9 shows how the variables in the first two factors are related to each other in space.

Table 6.45 Factor Analysis

FACTOR	EIGENVALUE	PCT.ofVAR	CUM. PCT.
1	24.15862	32.7	32.7
2	14.82688	20.1	52.8
3	6.31528	8.6	61.4
4	4.17465	5.7	67.1
5	3.88503	5.2	72.3
6	3.07613	4.2	76.5
7	2.85026	3.9	80.4
8	2.40681	3.2	83.6
9	2.10986	3.0	86.6
10	1.85730	2.8	89.4
11	1.48174	2.6	92.0
12	1.39001	2.3	94.3
13	1.6893	2.0	96.3
14	1.3015	1.9	98.2
15	0.98018	1.8	100.0

Table 6.46 Factor Analysis

FACTOR 1

Bizygomatic Diameter	0.95132
Gen. Facial Size Factor	0.91965
Biaural Breadth	0.90985
Bioccular Diameter	0.90177
Height of Face	0.83818
Left Eye Fissure Width	0.83356
Auricle-Chin Distance	0.81828
Vertical Ht.of Lower Face	0.80879
Right Eye Fissure Width	0.80606
Orbit-Auricle Distance	0.80567
Height of Upper Face	0.79737
Mouth Width	0.76514
Nasal Breadth	0.73171
Inter-Occular Distance	0.71481
Nasal Height	0.70473
Height of Whole Upper Lip	0.66150

FACTOR 2

Mouth Index	0.87443
Total Lip Height	0.74099
Lower Lip Height	0.72232
Upper Lip Height	0.64809
Nasal Breadth Index	0.55903
Upper Lip Angle	0.55473
Nasal Index	0.43415
Labial Pro/Retraction	0.36582
Ear Protrusion Index	0.33148
Nasal Wing/Septum Rel.	0.16891

FACTOR 3

Lower Facial Ht.Vert.Index	0.81166
Upper-Lower Fac.Ht.Index	0.71815

FACTOR 4

Lateral Proportion Index	0.70635
Nasal Angle	0.64227
Nasal Base Angle	0.64067
Chin Angle	0.56664
Mandibular Pro/Retraction	0.42470
Frontal Recession Angle	0.31436
Nasal Pro/Retraction	0.29171

FACTOR 5

Nasal Prom.-Bridge Index	0.94836
Nasal Brid.Dist.Lat.Index	0.92001
Nasal Bridge Index	0.84128
Nasal Bridge Distance	0.80699

FACTOR 6

Upper Face-Frhd.Ht.Index	0.83237
Lower Face-Frhd.Ht.Index	0.77203
Height of Forehead	0.63976

FACTOR 7

Nasal Ht.Prom. Index	0.88857
Nasal Prominence Index	0.81106
Nasal Prom. Lateral Index	0.77036
Nasal Prominence	0.67604

FACTOR 8

Occular Index	0.93436
Inter-Occular Width Index	0.86549
Int.-Occ.-Nas.Width Index	0.74643

FACTOR 9

Bioccular-Mth.Width Index	0.89291
Mouth Width Index	0.79166
Mouth-Nose Width Index	0.68090

FACTOR 10

Whole Upp.Lip Vert.Index	0.5927
Frontal Pro/Retraction	0.17719
Lower Face Prop.Index	0.74481

FACTOR 11

Lateral Prop. Index II	0.82608
Lateral Prop. Index I	0.64991

FACTOR 12

Eye Fissure Index	0.83548
Left Eye Fissure Height	0.66809
Right Eye Fissure Height	0.66467

FACTOR 13

Lip Index	0.41489

FACTOR 14

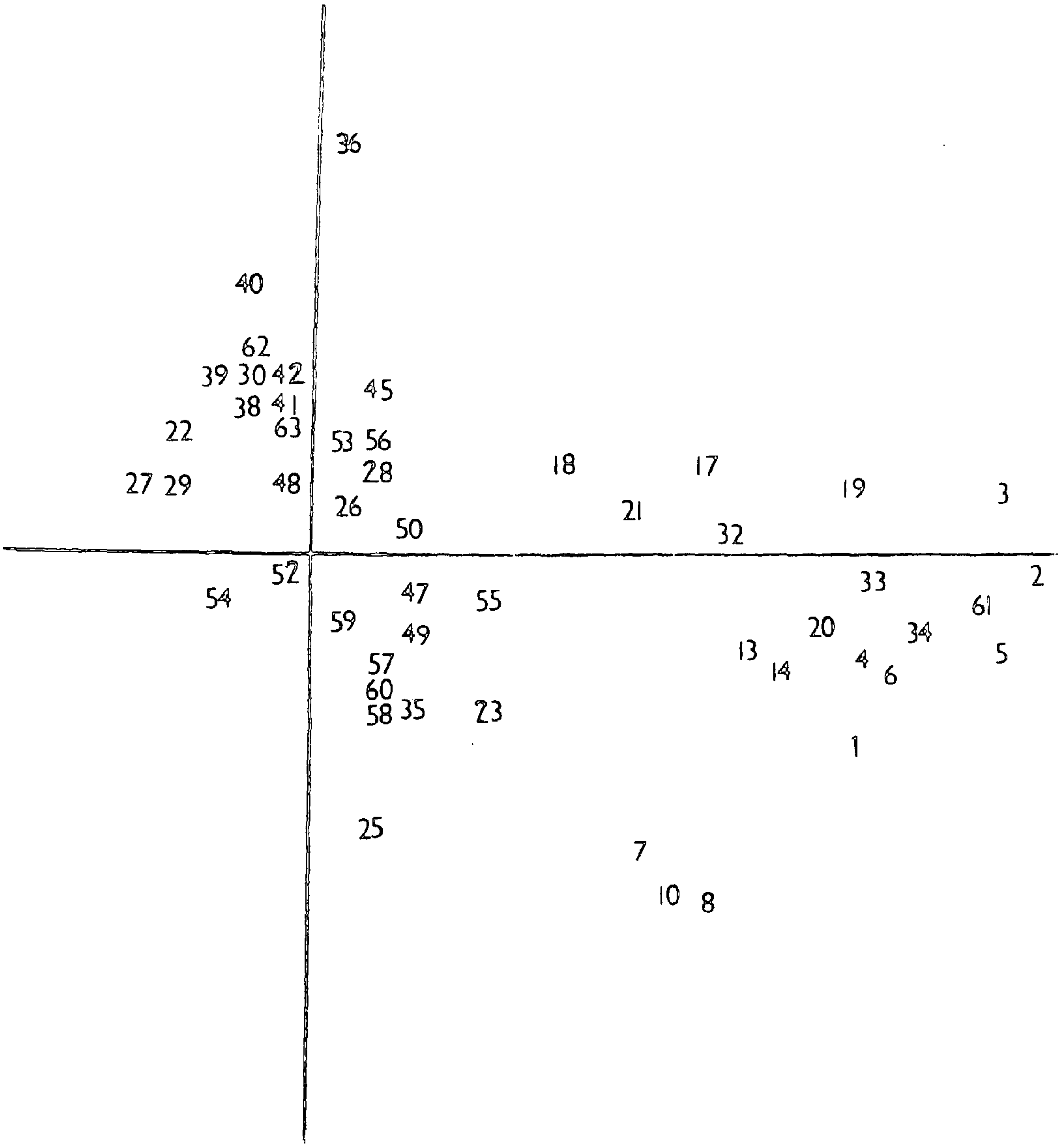
Columella Length Vert.Ind.	0.89114
Columella Length	0.77811

FACTOR 15

Bioccular Width Index	0.72945

Figure 6.9 — FACTOR ANALYSIS PLOT.

HORIZONTAL FACTOR 1 VERTICAL FACTOR 2



Key to Figure 6.9

1. Nasal Breadth
2. Bizygomatic Diameter
3. Biaural Breadth
4. Inter-Occular Distance
5. Bioccular Diameter
6. Mouth Width
7. Upper Lip Height
8. Lower Lip Height
9. Orbit-Auricle Distance
10. Total Height of Lips
11. Right Eye Fissure Width
12. Left Eye Fissure Width
13. Right Eye Fissure Height
14. Left Eye Fissure Height
15. Height of Face
16. Auricle-Chin Distance
17. Nasal Prominence
18. Nasal Bridge Distance
19. Nasal Height
20. Height of Whole Upper Lip
21. Columella Length
22. Nasal Angle
23. Nasal Base Angle
24. Nasal Wing/Septum Relationship
25. Upper Lip Angle
26. Chin Angle
27. Frontal Recession Angle
28. Frontal Protraction/Retraction
29. Nasal Protraction/Retraction
30. Labial Protraction/Retraction
31. Mandibular Pro/Retraction
32. Height of Forehead
33. Height of Upper Face
34. Vertical Height of Lower Face
35. Ear Protrusion Index
36. Mouth Index
37. Lip Index
38. Eye Fissure Index
39. Mouth Width Index
40. Nasal Breadth Index
41. Inter-Occular Width Index
42. Bioccular Width Index
43. Occular Index
44. Bioccular Mouth Width Index
45. Mouth-Nose Width Index
46. Inter-Occular Nasal Width Index
47. Upper Face-Forehead Ht.Index
48. Upper-Lower Facial Height Index
49. Lower Face-Forehead Ht.Index
50. Lower Face Proportion Index
51. Nasal Height-Prominence Index
52. Nasal Prom.-Bridge Index
53. Upper Lip Vertical Index
54. Nasal Columella Vertical Index
55. Lateral Prop. Index I
56. Lateral Prop. Index II
57. Lateral Prop. Index III
58. Nasal Prom. Lateral Index
59. Nasal Bridge Dist.Lat.Index
60. Nasal Bridge Index
61. General Fac. Size Factor Ind.
62. Nasal Prominence Index
63. Nasal Index

CHAPTER SEVEN - FACIAL PROPORTION AND THE CONCEPT OF BEAUTY

7.1 - Introduction

In this chapter the investigation into facial proportion and the construction of the ideal face is described. First a brief history of some of the classical and modern rules for the ideal proportions and ratios of the various parts of the face is presented. In Section 7.3 the actual rules which were selected for investigation are set out. In the next section the ways in which the sample of magazine models was obtained is described and in the final section the results of the in--vestigation and analysis of the data collected are reported.

7.2 - Theories of Beauty - A Historical Perspective

Most of the classical formulae concerning idealistic propor--tions of the head and face in human adults were developed by the Egyptians, adopted by the ancient Greeks and revived in the Rennaisance by Leonardo da Vinci and Albrecht Dürer among others. At various times since then the formulae have been reviewed. In the last few decades studies of facial proportions have been carried out with the purpose of applying the formulae to the practices of Plastic and Reconstructive Surgery.

The Egyptians were the first known to have discovered the Golden Number of Proportion. The discoverer and the date of discovery are, however, lost in antiquity. Seghers et al. (1964) suggest that it may have been one of the Egyptian priests who lived at the time of the construction of the pyramids. Cheops, the great pyramid, was constructed around 2900 B.C. and is based on the artistic application of the Golden Number, ϕ. The Egyptian rectangle was always eight parts long to five wide and this ratio 8/5, or 1.6, was the basis of their theories of ideal proportion (ϕ is taken as being 1.618).

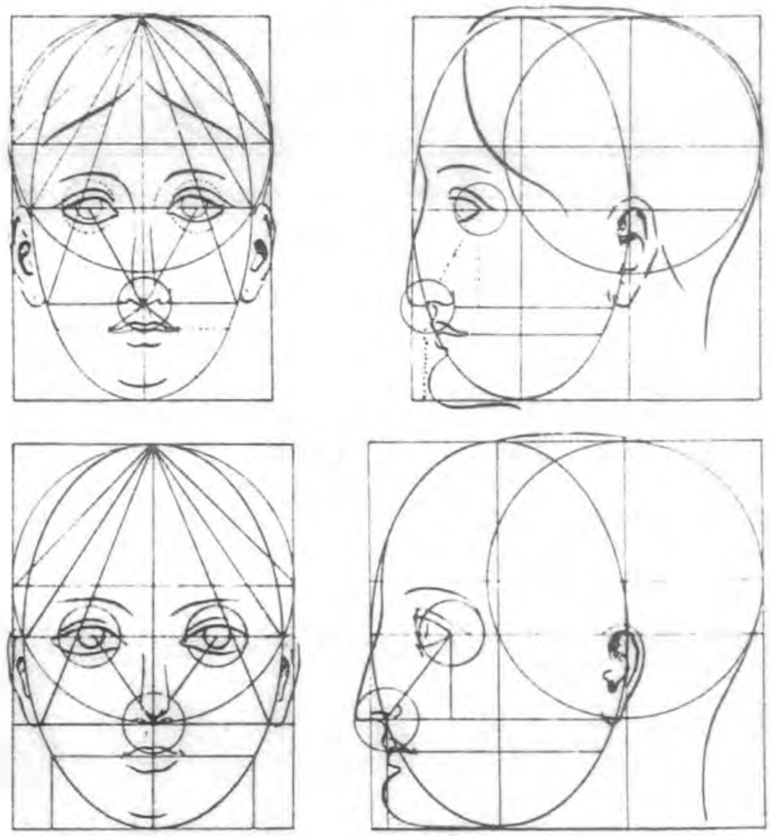
Following the Egyptians, the Ancient Greeks were the first to apply the concept of the Golden Proportion to human aesthetics. It was described in the fifth century B.C. by the Pythagoreans and a little later by the Greek geometrician Euclid. In the fourth century B.C. Aristotle reported older writings and traditions relating to the propor-tions of the human face. The person regarded to have been the first to formulate concepts about human aesthetics and the proportions of the face was Polykleitos, a famous sculptor of Ancient Greece. Polykleitos laid down the rules for the creation of human beauty and postulated a canon which is constantly referred to as the 'Golden Rule of Polykleitos'. Polykleitos can be regarded as the theoretician behind the Greek face in art which was to be a mathematically calculated structure based on the 'Golden Rule'. According to Pliny, Lissipus, one of the foremost Greek sculptors, used the work of Polykleitos as the basis for his sculp-tures. Polykleitos was thus the master, the theoretician, while Lissipus put his ideas into practice. Phidias was another influenced by the theoretical background of Polykleitos. His sculptures have been studied and analyzed and the Golden Proportion has been found manifested in them repeatedly. Seghers et al. (1964) call these sculptures "Gold Seekers" because of this.

Caltagorine and Kostecki (1955) suggest that the idea of Golden Proportions was transferred from the Greeks by the Etruscans to influence the Roman ideas of facial beauty. Although the Roman concep-tions of facial beauty is based loosely on the Greek ideas it is not solely mathematically created but relies more on ideas drawn from natural life. The Roman concept is that of 'harmony' of various parts of the face which must bear a definite ratio to one another. The Romans, how-ever, do not postulate that this ratio is a constant for all faces but is individually determined. Beauty is, therefore, according to the Romans, a more intuitive than mathematical concept.

The idea of 'harmony' is one that recurs throughout the writings on facial beauty. Plato had expounded this idea and, since he was a pupil of the Greek philosopher Socrates, the concept had probably been handed down to him. Durer in his theoretical works later (Dürer 1591) puts great emphasis on the harmony of various parts of the face, which he calls 'matching'.

In both the Greek and Roman conceptions of facial beauty the face is envisaged as an intricate assembly of spheres, curves and triang--les. Caltagorine and Kostecki (1955) have carried out detailed analyses of the face in Greek and Roman Art and have found that there are certain recurring ideal proportions. From these they have constructed the ideal varieties of ancient Greek and Roman heads. The ideal Greek heads are shown in Figure 7.1 depicting the delicate feminine and powerful mascu--line. In the statues of the heads of Apollo, Venus, Minerva, Juno, Hercules, Bacchus etc., these ideal proportions can be seen exemplified.

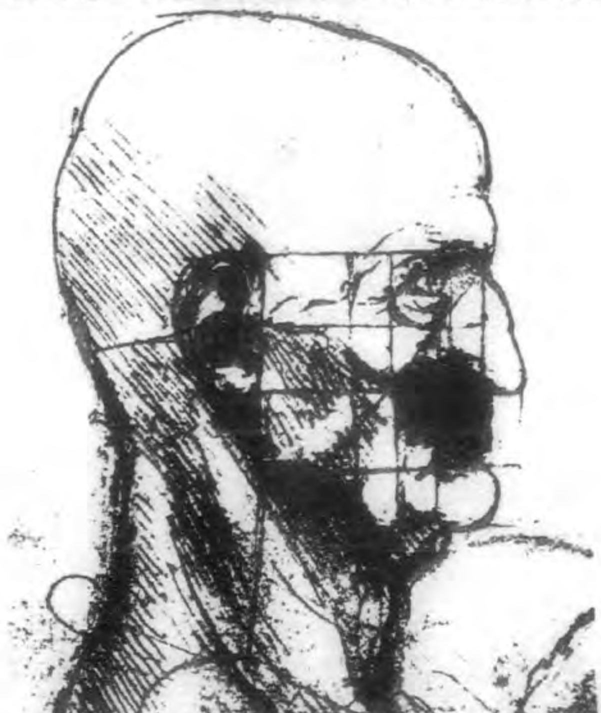
<u>Figure 7.1 Ideal Greek male and female heads based on the analysis of Caltagirone and Kostecki (1955) p.174</u>.



MALE AND FEMALE HEAD

During the Rennaisance the Italian School of Artists, and in particular da Vinci, were concerned with the study of the proportions of the human face. Da Vinci believed that the ultimate image of beauty must be contained in definite proportions. He, therefore, accumulated a vast amount of material on indices and proportions. These abound in sketches and the annotations to them, for example, the drawing in the Venice Academy on the Study of Human Proportions, his preparatory studies for the painting "The Battle of Anghiari" (see Rosci (1978), da Vinci (1957)), his "Rule for the Proportions of the Human Figure according to Vitruvius, also in the Venice Academy and his study of Skulls and Faces in the Royal Library at Windsor. The sketches are so numerous and da Vinci's data is so contradictory, however, that they cannot be used as a basis for making a canon of his proportions. A design that he repeats frequently, however, is one in which a line is drawn touching the super--ior margin of the orbit and then passing down to the Labial Fissure. This line is used to indicate the ideal situation of the eyes and the relative position of the ear and nose, (Gonzalez-Ulloa, 1962) see Figure 7.2a. He also described a method of analyzing the profile of the face with a semicircle with the porion as its centre.

Figure 7.2a A sketch by da Vinci to obtain the relation of different segments of the face

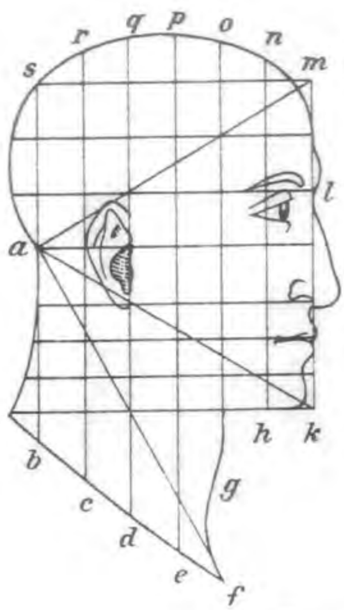


The parts of the face should touch this line (see Figure 7.2b). Pacioli discusses the theme of relative proportions in his work on the 'Divine Proportion', (Pacioli, 1946). As shown in Figure 7.3, he in--cludes the different segments of the face in a lateral triangle design--ated amk. This triangle, according to Pacioli, can be used to locate

Figure 7.2b Leonardo Da Vinci's method of analyzing the facial profile. A semi-circle is drawn with its centre at the top of the external audi--tory meatus. The points marked with arrows (glabella, pronasale, pro--gonion) should, in the ideal face, all touch the semi-circle.

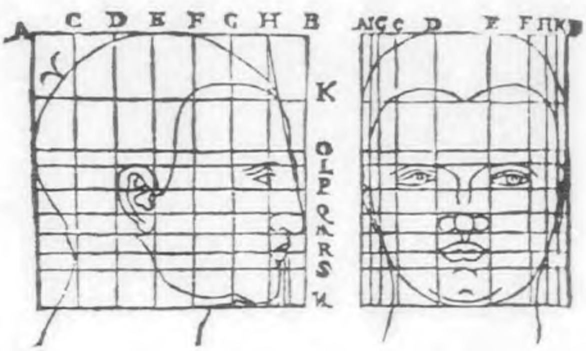
the ideal positions of the various features of the face. Note that he includes a vertical line passing through the nasion and subnasale. A line which seems to be repeated in the works of many writers on this theme.

Figure 7.3 L. Pacioli's 'Divine Proportion' to localize the diverse segments of the face (Pacioli, 1946)



The Italian concern, the problem of the beauty of proportions, which had been investigated particularly by Leonardo da Vinci, also fas--cinated the German artist Albrecht Dürer. In long laborious studies he examined the question of how the perfect human figure and face was constituted. Dürer reported a large number of measurements of the face (Dürer 1591) and attempted to analyze the differences and the manner in which these differences can affect the face. Dürer searched for a des--cription of 'beauty' that was "independent of men's opinion" ,(Wolfflin, H. (1971) p.35) since he felt that beauty was something one ought to be able to "prove". He felt that, since human judgement varies, beauty should be able to be likened to a mathematical theorem. At the beginn--ing Durer used geometrical constructions with circles and rectangles but later he began more and more to make only measurements of lengths, both horizontal and vertical. Dürer also described his standard type, for which he gives a series of measurements and from which he creates his diagram for beauty (see Figure 7.4). His horizontal line starts at the lower lobe of the ear and goes towards the nasal base. He describes the distribution of the face as composed of similar thirds. The first of these thirds extends from the hairline to the eyebrow; the second from the eyebrow to the base of the nose; and the third, which is divid--ed into two parts, one half for the lips and the other for the chin.

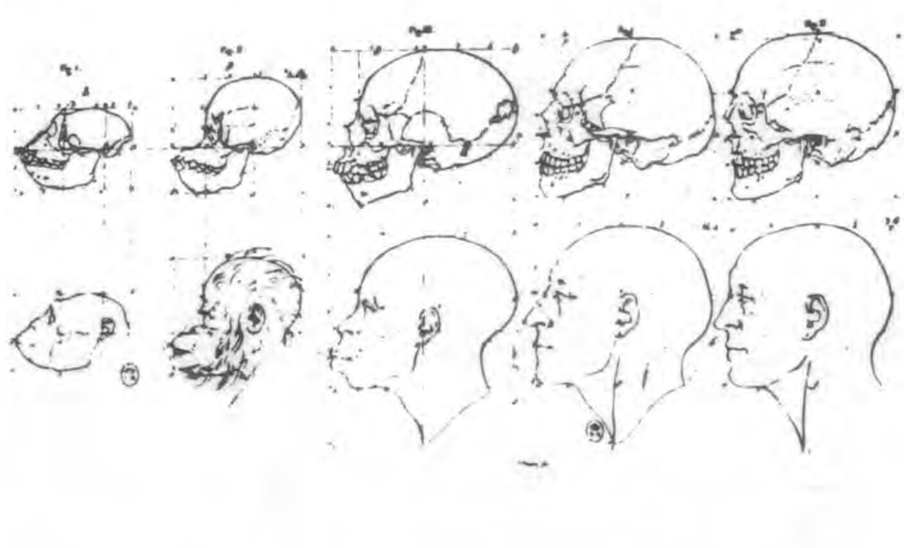
Figure 7.4 Dürer's diagram for beauty



Dürers influence was Jacopo de Barbari, a Venetian painter belonging to the Italian school, who initiated Dürers search for regular proportions. Later he turned to Vitruvius, Alberti and da Vinci. In his work on proportion he operated a double method; firstly, using vari--ous fractions of the overall length and secondly, using the unit of $\frac{1}{6}$ th of the overall length, a method he borrowed from Alberti.

John Caspar Levater, an eighteenth - century Swiss, concerned himself with the form of the profile of the human face. He tabulated the various different profiles he encountered and attempted to use them for somatology of the individual. He considered the lateral profile view to be the most adequate in the study of the face (Lavater, J.C. 1780). He portrays his ideal type with a slant in the facial plane similar to that proposed later by Gonzalez - Ulloa (1962). Camper, near the end of the 18th Century, attempted to comprehend the factors responsible for beauty. His conclusion was that beauty was above all a matter of pro- -portion. Camper was also responsible for the invention of a line from the centre of the external auditory meatus to the wing of the nose, known as "Camper's plane". Another line from the glabella to the alveo- -lar margin of the upper jaw formed "Camper's Angle". He used this angle to demonstrate racial differences. Camper attempted to employ geometric methods to measure the character of man. His theory was that man becomes more similar to the beast in proportion to the progressure slant of the straight line that goes from the forehead to the upper lip. From his studies (Camper, 1794) he produced diagrams which showed that a simple change in the facial axis shows the diverse characters of man one by one as they appear in the dimension of time and the scale of evolution (see Figure 7.5a). This theme was furthered by Broca and Topinard in the nineteenth century who put forward the theory of the "Human Ladder" of evolution (see Figure 7.5b). Topinard erroneously described the measurement of the facial angle as a test of intelligence of racial "types", (Ferguson, 1984)

Figure 7.5a Camper's diagram showing head modifications in the scale of evolution



<u>Figure 7.5b</u> — <u>The Human Ladder</u> (from Ferguson, 1984)

With the introduction of standardized planes of reference; the Frankfort Plane in 1884 at the International Congress of Anthropology and the Frankfort Horizontal Plane introduced by Von Ihering, anthropolo--gists began to analyse faces using this line. Retzius, classified the races of man according to whether they were orthognathic (straight jawed) or prognathic (prominant jawed), a concept which was later used for the analysis of beauty.

Prior to this, Zeising (1854 and 1855) had gone back to exam--ining the proportions of the head and comparing his results with the Golden Number ϕ. He found that of his measurements the proportions of the male face were closer to ϕ than were those of the female. Ghyka

(1931 and 1946) worked on the harmonic proportions according to the golden section. In his work M.C. Ghyka often quoted Zeising. Figures 7.6 and 7.7 show the harmonic analysis of the face of a famous sports-woman as carried out using strict golden proportion by Ghyka. Figure 7.7 shows how the golden number $\phi = 1.618$. Zeising had found (Zeising 1854) that, in his studies, the male proportions fluctuated around the average proportions $^{13}/8$ or 1.625 which was closer to ϕ than the proportions of the female face which was $^{8}/5$ or 1.6, ($\phi = 1.618$).

<u>Figure 7.6 Harmonic analysis by Ghyka (1931)</u>

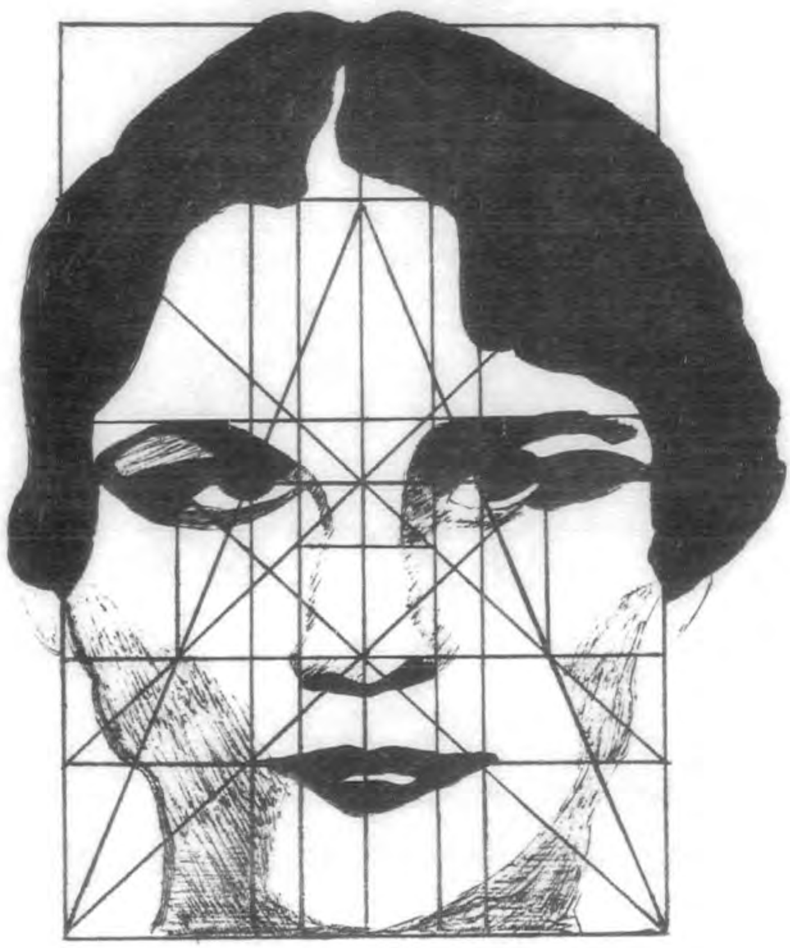
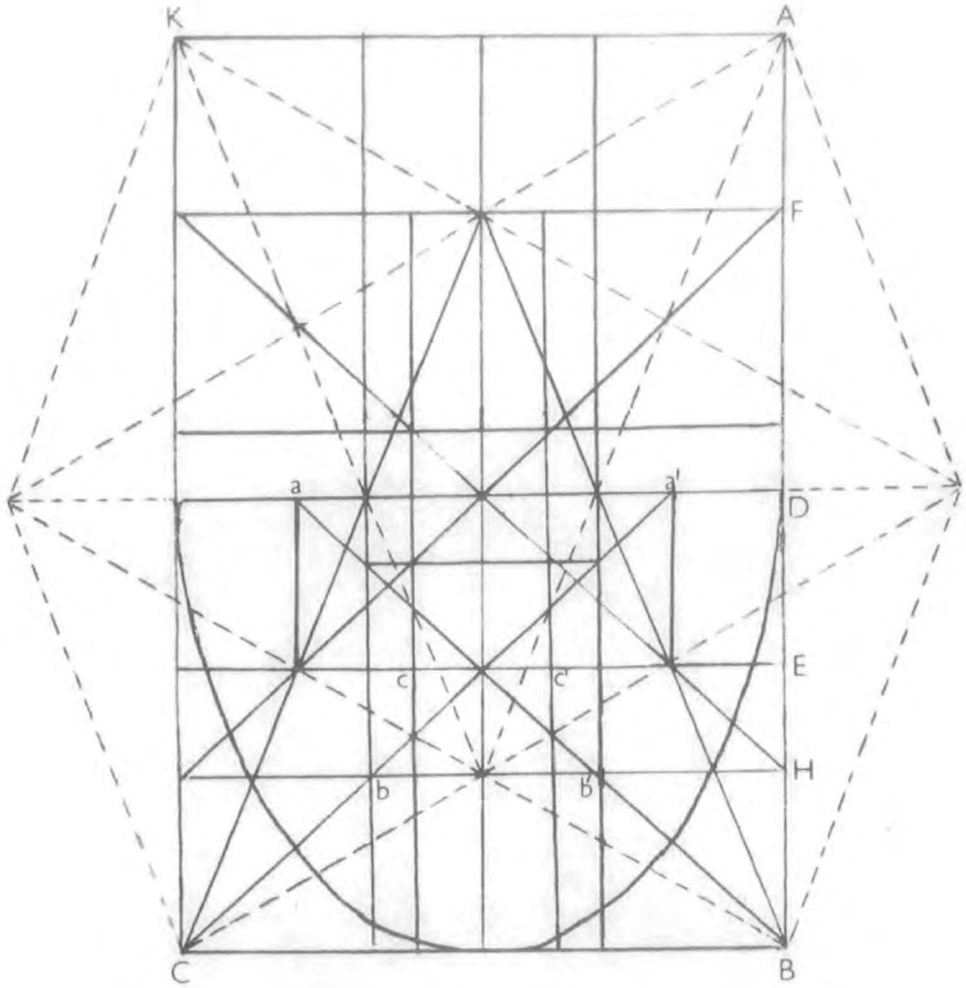


Figure 7.7 Diagram of the proportions of the face shown in Figure 7.6



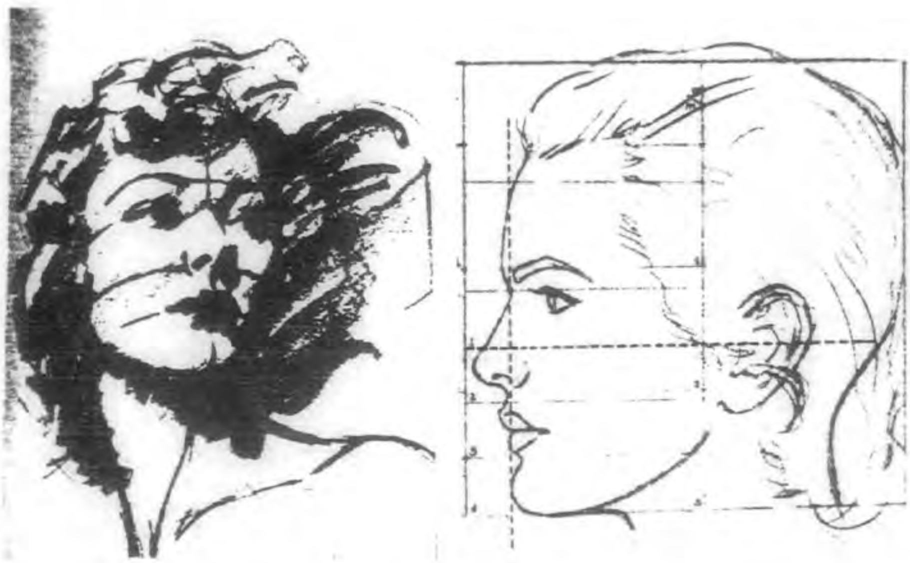
$$\frac{AB}{BC} = \frac{AD}{FD} = \frac{DB}{FB} = \phi = \frac{\sqrt{5+1}}{2}$$

$$\frac{FD}{DE} = \frac{DH}{DE} = \frac{EB}{HB} = \phi \qquad \frac{CB}{aa'} = \frac{aa'}{bb'} = \frac{bb'}{cc'} = \phi$$

Contemporary artists such as Loomis (1958) have furnished a profusion of rules which all claim to suggest the proportions necessary for a beautiful face. Loomis's pattern for beauty is most typical with the face being split into a top and lower half with the eyes being the midpoint in the length of the face. Again the idea of equal thirds of the face comes up (see Figure 7.8).

Other artists before Loomis had studied the proportions of the face and how these were related to beauty. Notable among these were Anton Pevsner, Naom Gabor, Schadow, Albrecht, Michelangelo, Cezanne and the Cubists who all devoted great amounts of time to study--ing the various proportions of the face and incorporated their findings in their paintings.

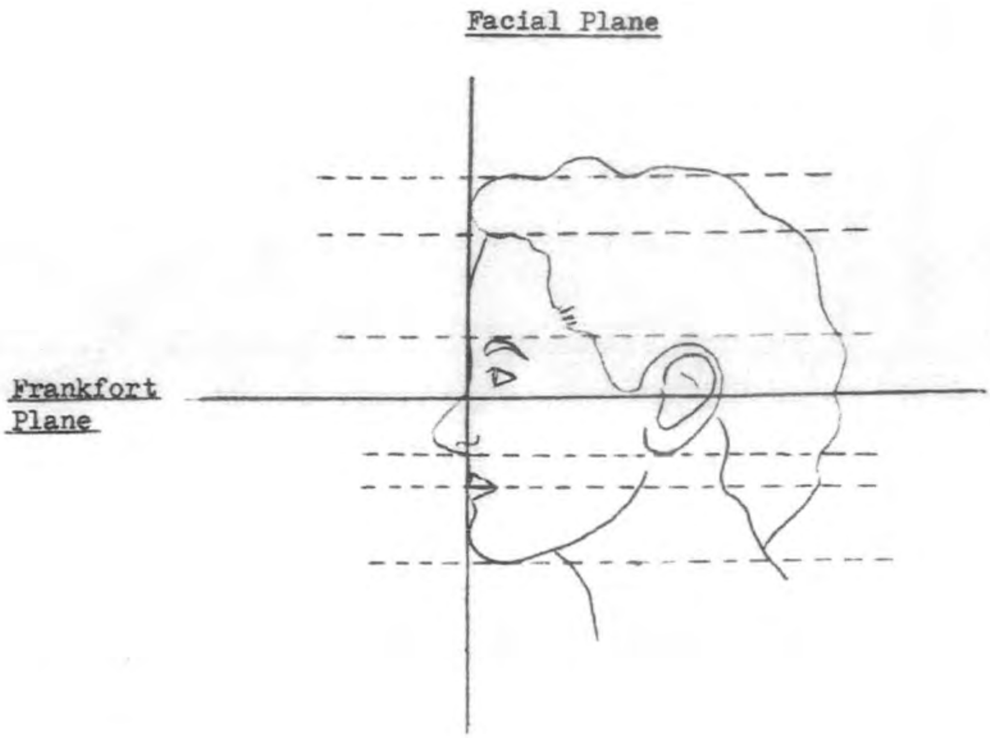
Figure 7.8 Loomis' Pattern of Beauty



In recent years researchers working in the field of plastic and reconstructive surgery have revived the old formulae of facial proportions and added new ones themselves. These have been used as a basis of what the ideal face should be and have been applied in the surgical reconstruction of the face. Notable amongst these researchers are Broadbent and Matthews (1957), Gonzalez - Ulloa (1962), Seghers et al. (1964), Neger (1959), Patterson and Powell (1974), Webster (1975), Belinfante (1979) and Krugman et al. (1979).

Gonzalez - Ulloa (1962) concerns himself with the facial pro--file. He usese two lines, the Frankfort horizontal plane and a line drawn at 90 degrees passing through the nasion and subnasale and called the Facial Plane. These lines serve as a basis for the distribution of the different features of the face (see Figure 7.9). In his paper Gonzalez-Ulloa shows that the same two lines can be drawn through the faces of almost all of the beautiful faces of history with all of the segments of the face aligned to the facial plane and the two planes forming a right-angle. His theory of beauty is that the forehead, nasal, labial and mandibular regions should all touch the facial plane (Figure 7.9), Gonzalez-Ulloa has applied this in the surgical process of profileplasty.

Figure 7.9 Two lines used by Gonzalez-Ulloa (1962). In his canon of beauty, the forehead, nasal wing, mouth and mandibular region all lie on the facial plane



Broadbent and Matthews (1957) found from their investigations that there appear to be certain ideal proportions for the face. The width of the face should equal half the height of the head. In both full - face and profile views the face can be divided into quarters :-

$^{1}/4$ from Vertex to trichion level

$^{1}/4$ from trichion to exocanthion level

$^{1}/4$ from exocanthion to subnasale level

$^{1}/4$ from subnasale to gnathion level

(see Figure 7.10)

The interoccular distance should be equal to the width of the eye (see Figure 7.11). The subnasale - labiale inferius is equal to the labiale inferius - gnathion level i.e. the distance between base of nose and chin can be divided into two equal halves (see Figure 7.12). This region can also be divided into thirds as shown in Figure 7.12.

Figure 7.10 Broadbent and Matthews - Ideal Proportions

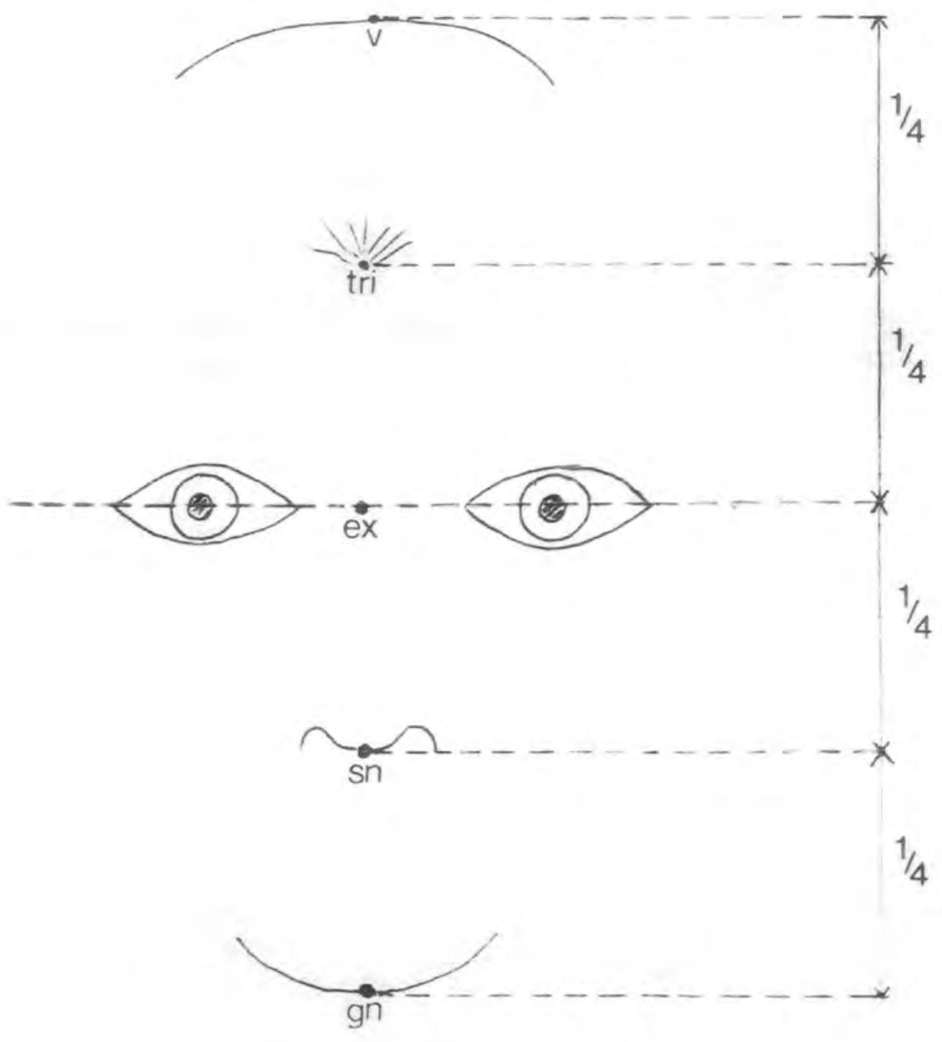


Figure 7.11 Broadbent and Matthews' Ideal Proportions - Eyes (A=B=C)

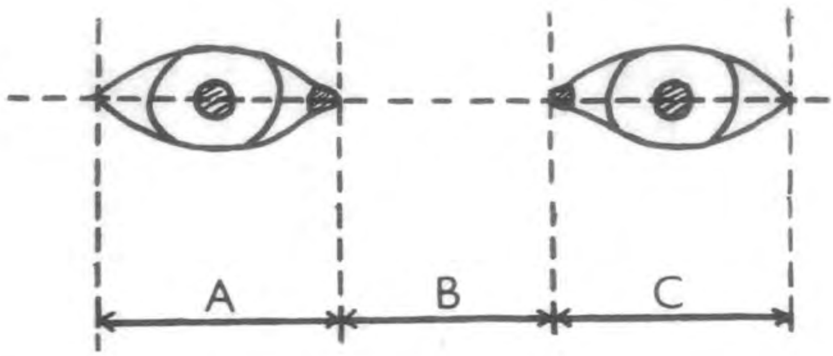
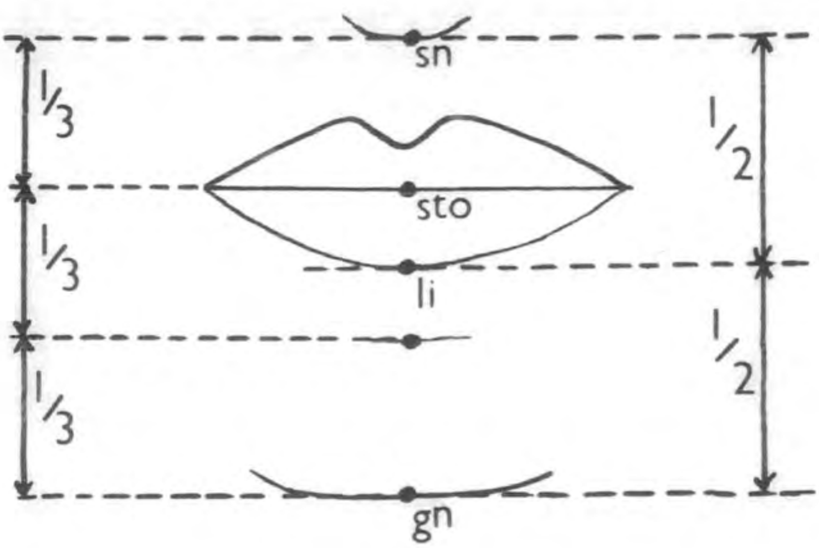


Figure 7.12 Broadbent and Matthews' Ideal Proportions - Lips and Mouth Region



Another rule of beauty which occurs commonly in researchers work (Gonzalez-Ulloa, 1962; Loomis, 1958; Farkas, 1982; Dürer, 1591) is that there should be three parts of the face which are of equal length. These are the trichion to superciliare distance, the superciliare to subnasale distance and the subnasale to gnathion distance. The distance from subnasale to stomion should be one third of the distance from sub--nasale to gnathion (Gonzalez-Ulloa, 1962; Broadbent and Matthews, 1957), and also the vertex - trichion distance should be one third of the ver--tex - superciliare distance (Gonzalez-Ulloa, 1962).

Neger (1959) concerned himself with the profile of the ideal face. He was particularly interested in the angles created by the lips and chin with lines projected from the subnasale. He used the photo--grammetric method in his investigation and found that for the ideal face the angles produced should be extremely small as people with facial de--formities had the largest angles (e.g. in prognathia or protruding lips). This ties in with the vertical facial plane line suggested by Levator, 1780; Pacioli, 1946; Camper, 1794 and Gonzalez-Ulloa, 1962 and 1964.

Patterson and Powell (1977) investigated some of the old and modern rules of beauty in an effort to produce some guidelines for plastic surgeons in cosmetic surgery. They come to the conclusion that the first rule of beauty is that the ideal face should be able to be divided into three equal parts. They differ from the other researchers, however, by making their second dividing line the nasion and not the superciliare as in Gonzalez-Ulloa, 1962; Loomis, 1958 and Durer, 1591. Their ideal face apart from this is similar to other researchers. They agree with Broadbent and Matthews that the vermillion border of the lower lip (li) is midway between the subnasale and the gnathion. They postulate that the subnasale-stomion distance should be $^1/_3$rd and the stomion-gnathion distance $^2/_3$rds of the distance between subnasale and gnathion (see Figure 7.12) as do Broadbent and Matthews. Patterson and

Powell also postulate that in the ideal face the nasal angle should be between 30 and 36 degrees. The width of the nose should also be equal to the width of one eye as well as equalling the interoccular distance.

7.3 - Applying the theories of the ideal face

From the various thoories concerning the proportions and con-stitution of the ideal face, in terms of beauty, some of the more wide-ly held were selected for testing. These were used to determine if the faces of people who are considered to be beautiful today matched up to the requirements postulated in the various theories selected and so to see if these theories still held true.

The theories selected for testing were; the harmonic analysis of Ghyka (1931) and the equations to determine the Golden Number Ø associated with it; the theory of equal thirds of the face (Gonzalez-Ulloa, 1962; Dürer, 1591); the idea of a vertical facial plane at right-angles to the horizontal Frankfor Plane and with all of the seg-ments of the face touching this line (Levator, 1780; Camper, 1794; Pacioli, 1946 and Gonzalez-Ulloa, 1962); the theory that the total height of the face could be divided into equal halves and these in turn could be divided to provide four equal quarters to the face (Broadbent and Matthews, 1957 and Loomis, 1958); and finally the theory that angles subtended by lines drawn to features of the lower face and the facial plane should be close to zero degrees for the ideal face (Neger, 1959).

The theories were put to the test on photographs of magazine models, both male and female. The purpose was to determine how much closer they came, as a group, to the ideal standards set out by the various writers than did the samples of people from Great Britain and Tanzania.

The methods for carrying out the tests, the measurements taken for each test and the indices computed are described in Sections 7.3(i) - (vi).

7.3(i) - Harmonic analysis of the face - the Golden Number

From the diagram constructed by Ghyka it was possible to carry out harmonic analysis of the faces. Ghykas equations for comput--ing the Golden Number were as follows: -

$$\frac{AB}{BC} = \frac{AD}{FD} = \frac{DB}{EB} = \phi = \frac{\sqrt{5}+1}{2} = 1.618$$

$$\frac{FD}{DE} = \frac{DH}{DE} = \frac{EB}{HB} = \phi$$

$$\frac{CB}{aa} = \frac{aa}{bb} = \frac{bb}{cc} = \phi$$

(See Figure 7.13 and Figures 7.6 and 7.7)

AB = V - gn

BC = zy - zy = Bizygomatic diameter = measurement 1

AD = v - ex

FD = tri - ex

DB = ex - gn

EB = prn - gn

DE = ex - prn

DH = ex - sto

HB = sto - gn

aa = ex - ex = Bioccular diameter = measurement 5

bb = ch - ch = Mouth width = measurement 6

cc = al - al = Nasal breadth = measurement 3

Using the nomenclature as described in Chapter 3.

It can be seen that only four of the twelve measurements re--quired had been measured for the first part of the investigation. The other distances, measuring points and their locations are described below and shown in Figures 7.14 and 7.15. The measurements already taken i.e. measurement 1, 3, 5 and 6 are described in Chapter 3, Sect--ion 3.5(i). From Figures 7.14 and 7.15 it can be seen that eight more measurements are needed to complete the harmonic analysis. These are shown in Figure 7.15. To make these measurements a new landmark must first be defined and located, the rest are defined in Chapter 3. The

Figure 7.13 Diagram for harmonic analysis of face and determination of the Golden Number

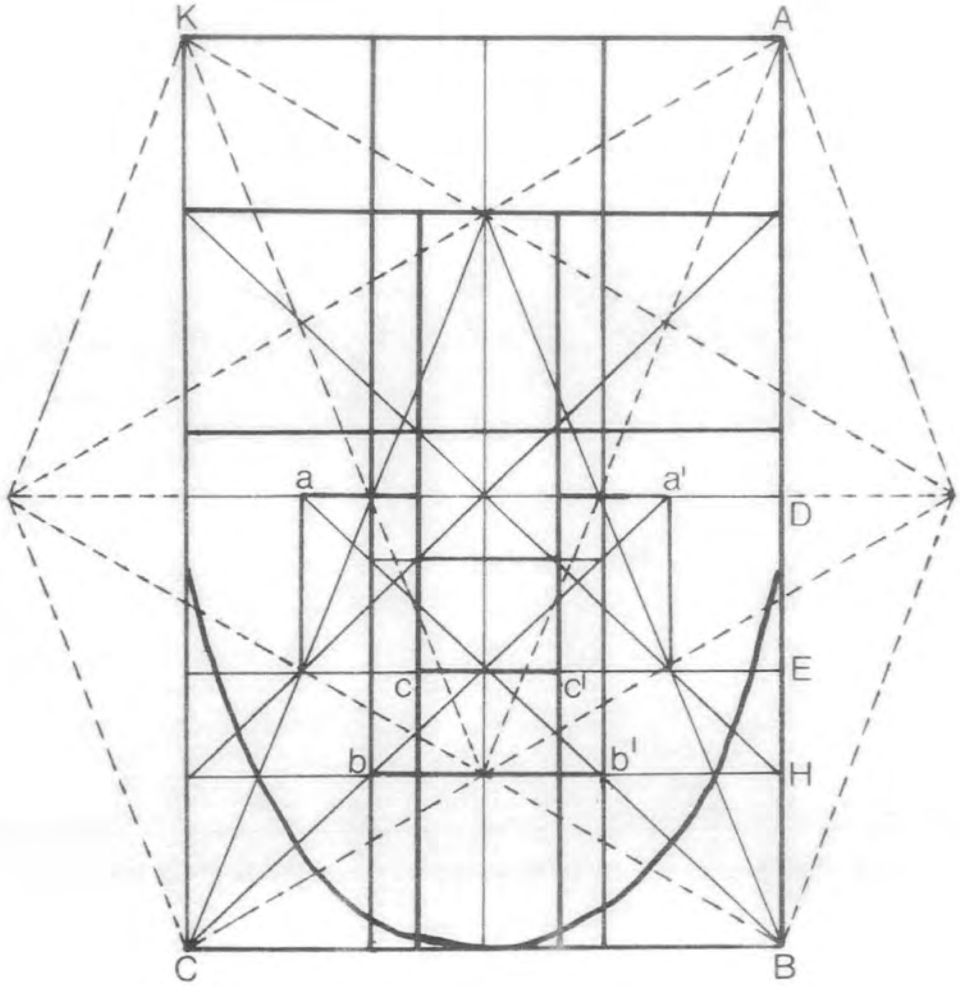


Figure 7.14 Extra Landmarks used in harmonic analysis of the face

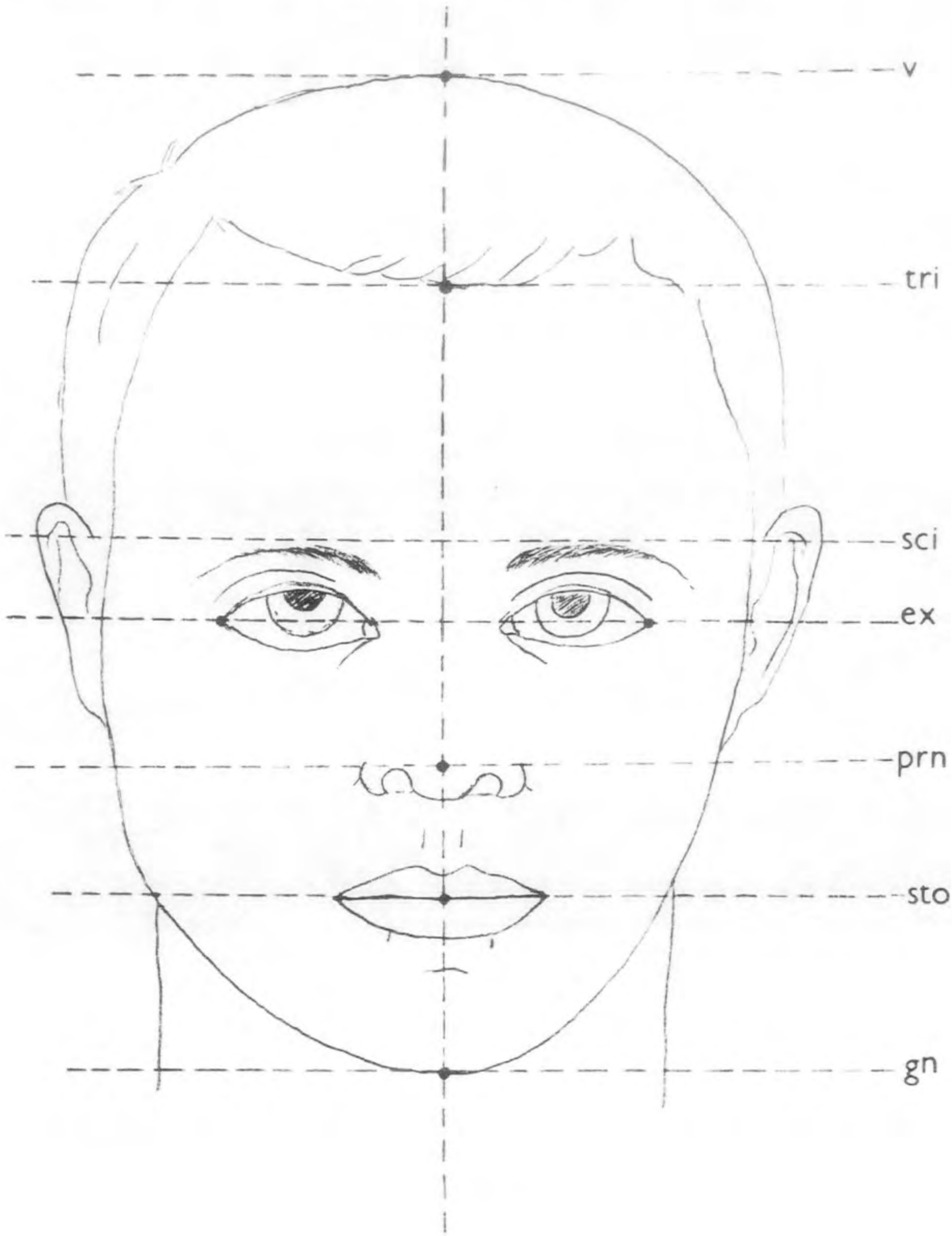
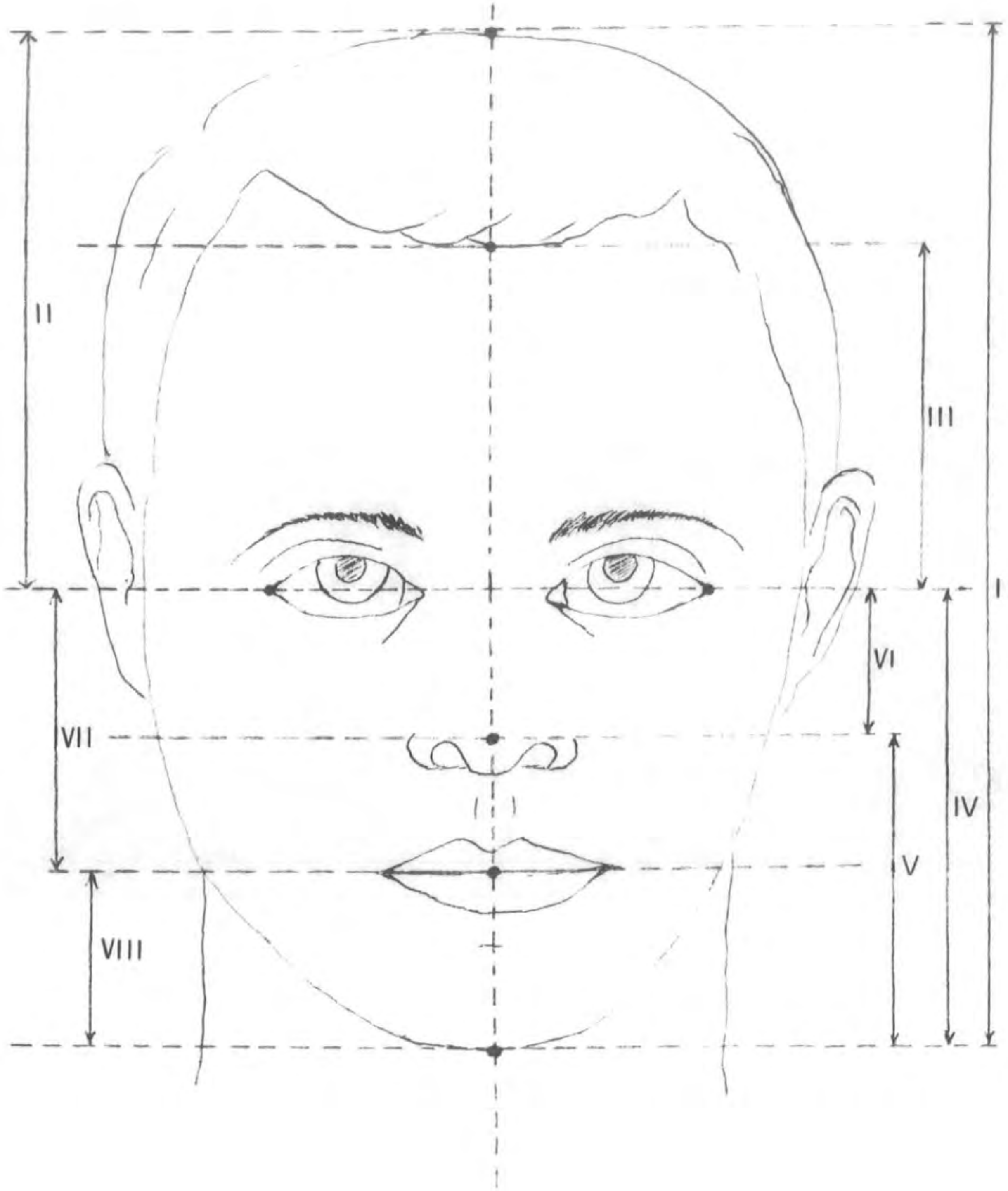


Figure 7.15 Extra measurements taken for harmonic analysis and Golden Number determination



new landmark is the Vertix (v) which is the highest point of the head when the head is orientated in the Frankfort Horizontal Plane.

The extra measurements are shown in Figure 7.15 and, using the notation in the diagram, are as follows;-

I = Vertex-gnathion distance (v-gn)
II = Vertex-exocanthion distance (v-ex)
III = Trichion-exocanthion distance (tri-ex)
$\overline{\underline{\text{IV}}}$ = Exocanthion-gnathion distance (ex-gn)
$\overline{\underline{\text{V}}}$ = Pronasale-gnathion distance (prn-gn)
$\overline{\underline{\text{VI}}}$ = Exocanthion-pronasale distance (ex-prn)
$\overline{\underline{\text{VII}}}$ = Exocanthion-stomion distance (ex-sto)
$\overline{\underline{\text{VIII}}}$ = Stomion-gnathion distance (sto-gn)

Note that all of these are vertical distances and are measured after the head has been orientated in the horizontal plane around the outer corners of the eyes and a vertical guideline has been constructed, (see Table 7.1).

<u>7.3(ii) - Equal Thirds of the face</u>

This is a common rule of beauty cropping up in the work of many writers e.g. Dürer, 1591; Loomis, 1958; Gonzalez-Ulloa, 1962 and Pacioli, 1946. The three thirds of the face to be measured and com--pared are all vertical distances;-

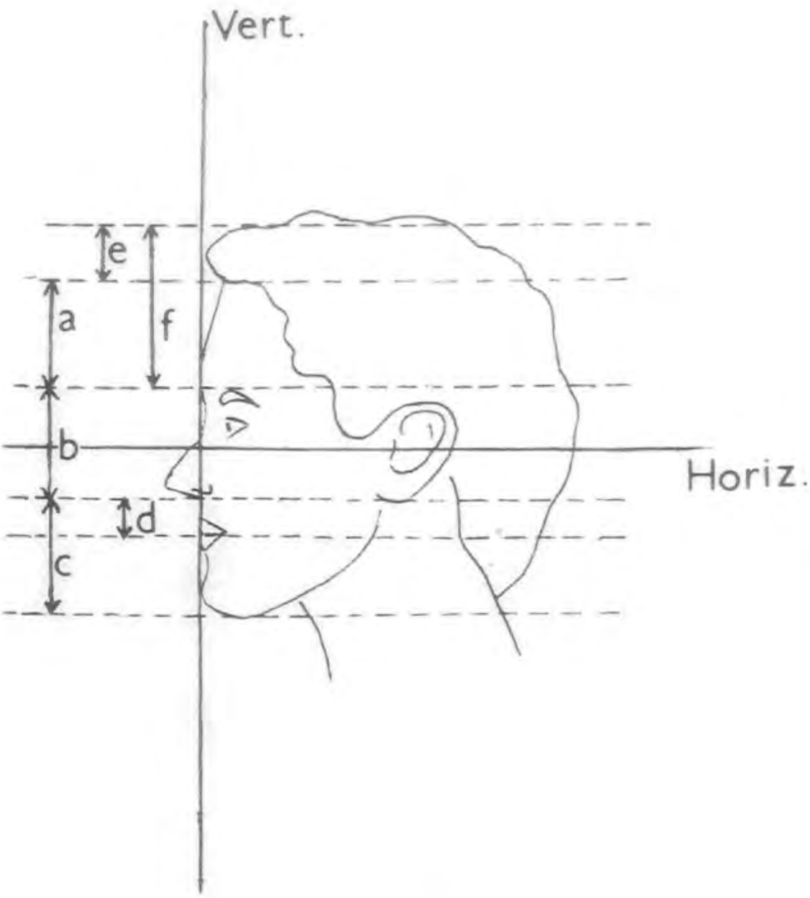
a = trichion to superciliare distance (tri-sci)
b = superciliare to subnasale distance (sci-sn)
c = subnasale to gnathion distance (sn-gn)

(See Figure 7.16)

According to the theory, all of the lengths a, b and c should be equal.

In addition;- d = subnasale to stomion (sn-sto) should be $^1/_3$rd the length of c - subnasale-gnathion distance (sn-gn) and also e, the vertex to trichion distance (v-tri) should be $^1/_3$rd of the vertex-superciliare distance (v-sci), or f. This test can be carried out using either frontal or lateral profile views.

Figure 7.16 Diagram for 'Thirds of Face' analysis



7.3(iii) - Alignment of features to facial plane

This test had already been carried out on the British and Tanzanian samples in the form of whether the frontal, nasal, labial and mandibular areas of the face protracted, retracted or lay along the vertical facial plane (see Figures 7.17 and 7.18). The test was re--peated for the magazine model sample. According to Levator, 1780; Pacioli, 1946; Camper, 1794; Gonzalez-Ulloa, 1962, in the ideal face, all of the areas mentioned above should be along the facial plane which is constructed at 90 degrees to the horizontal (see Figure 7.17). See Chapter 3 for details of how the test was carried out. Section 3.5(v) and Figure 7.18 show how the facial profile deviates from the norm. The profile views are score +, if there is protraction, - if there is retraction and 0, if the feature lies on the facial plane which is the ideal (see Figure 7.17). These are described fully in Chapter 3 (measurements 31 - 34).

Figure 7.17 Ideal Design for Facial Profile

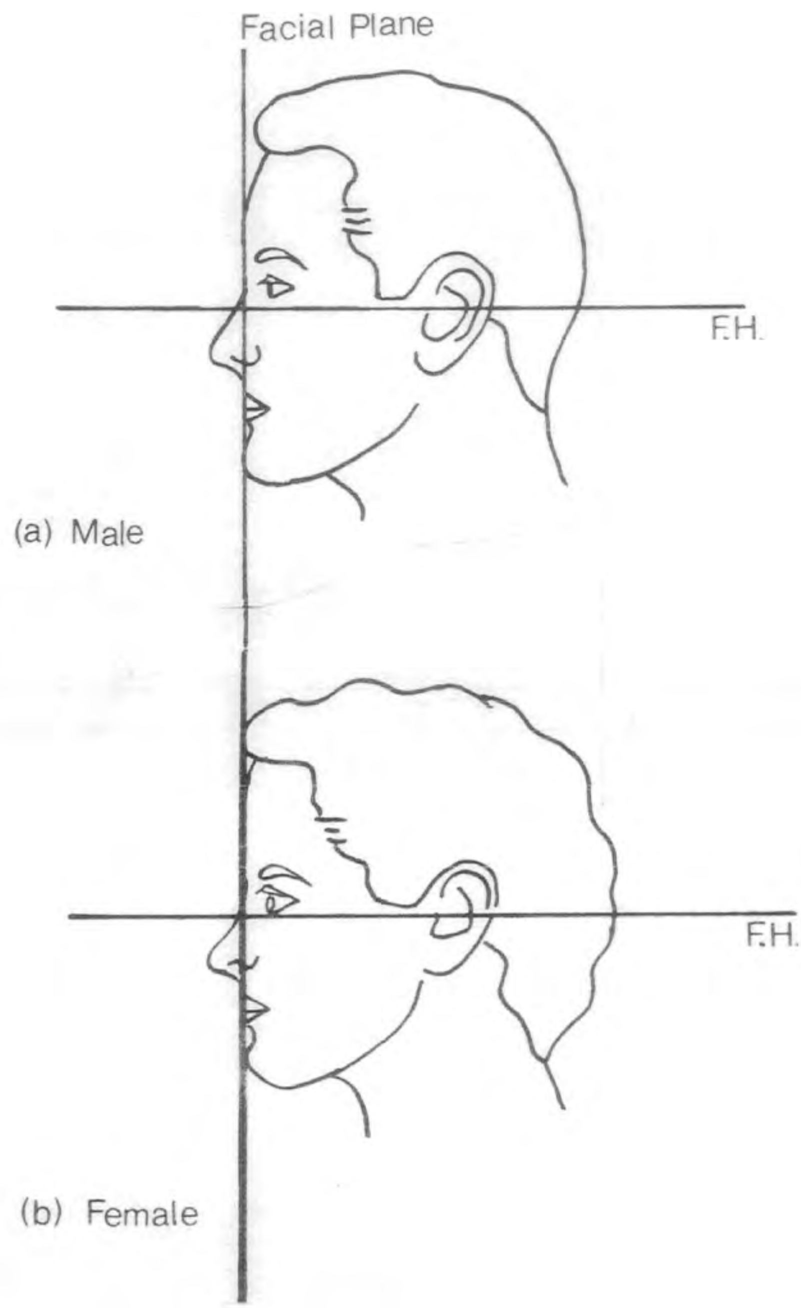
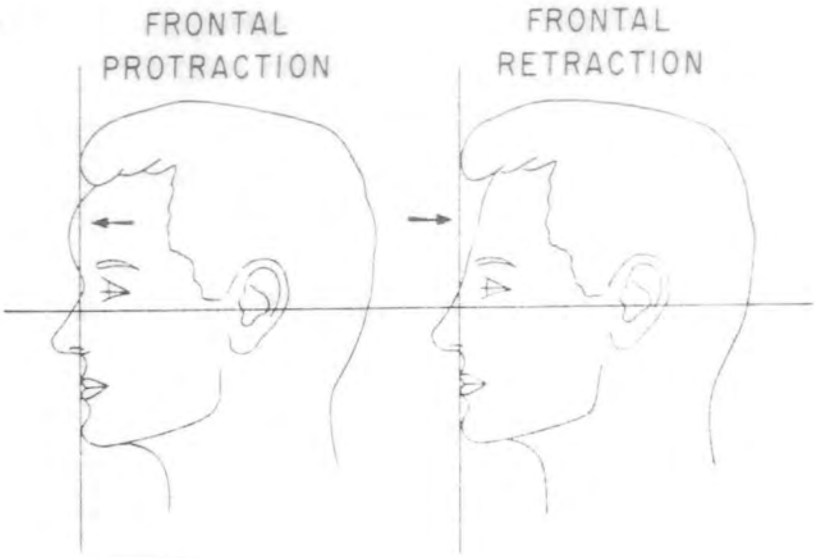


Figure 7.18 Deviations of Facial Profile from Ideal

(a)



(b)

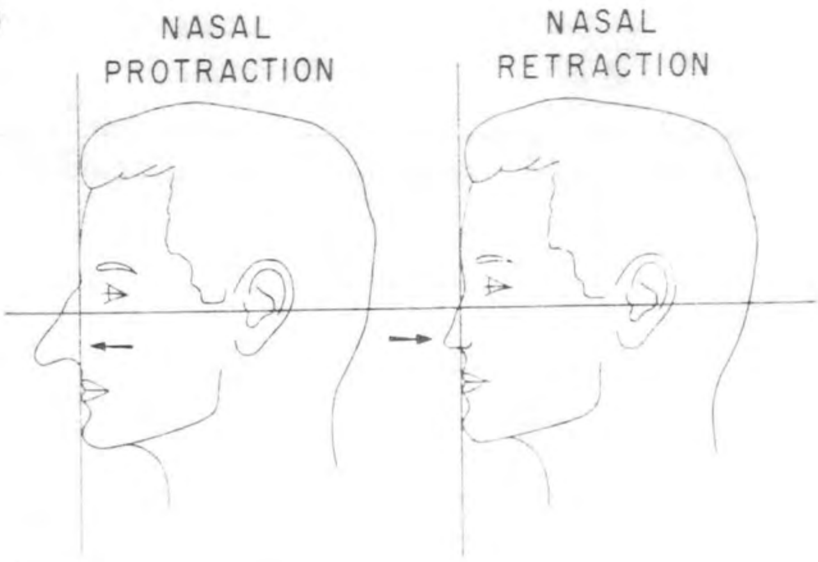
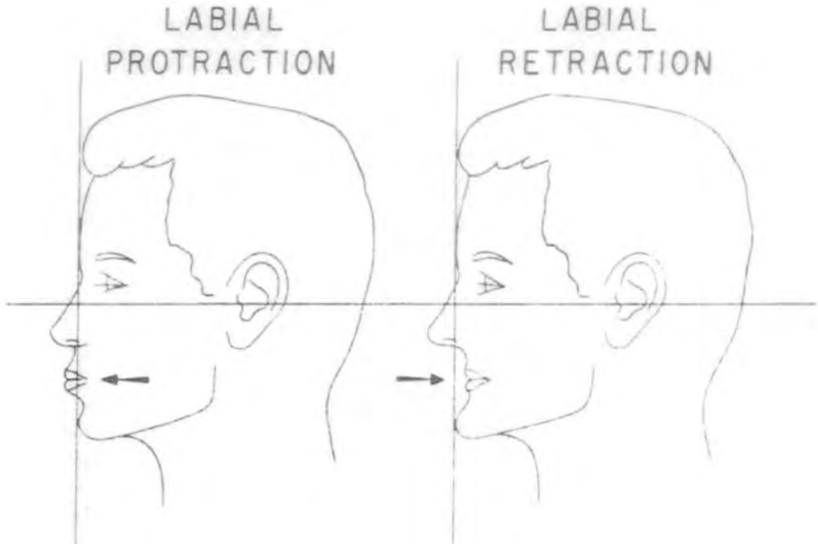
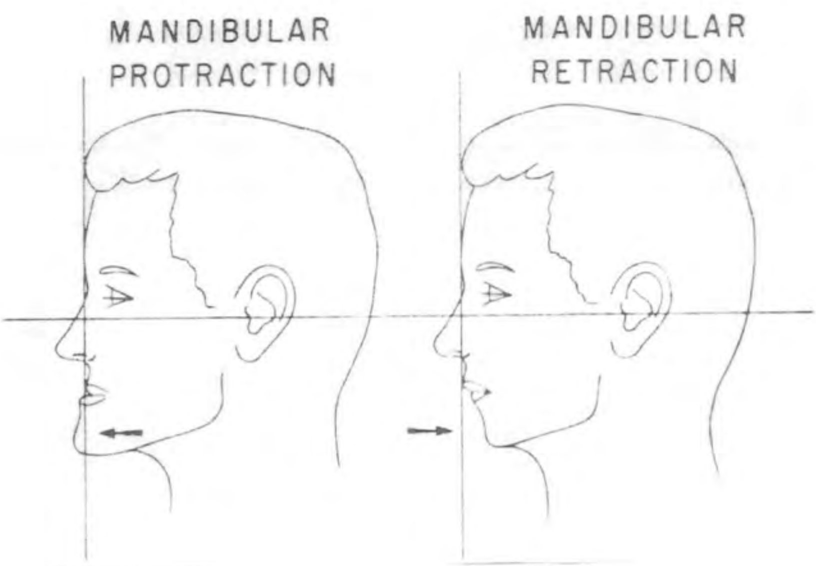


Figure 7.18 (continued)

(c)



(d)

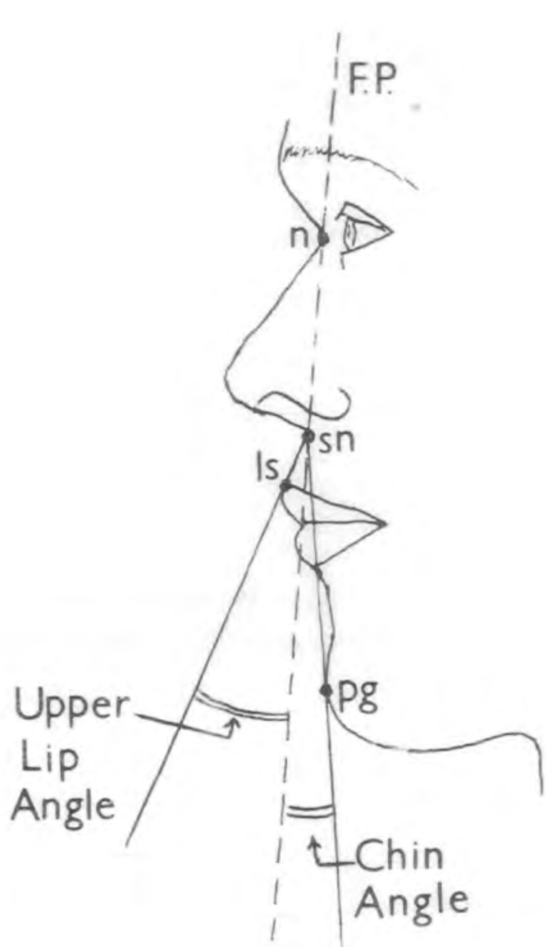


7.3(iv) - Angles of lower face in relation to the vertical facial plane

This theory, put forward by Neger (1959), is that the angles subtended by lines drawn to various facial landmarks of the lower face should be closer to zero degrees that for the average person.

The angles used for this test are measurements numbers 27 and 28 from Chapter 3 - these are the Upper Lip Angle and Chin Angle. They are shown in Figure 7.19.

Figure 7.19 Upper Lip Angle and Chin Angle



7.3(v) - Equal quarters of the face

(a) This theory, put forward by Broadbent and Matthews (1957), states that the ideal face should be divisible vertically into four equal quarters, which are:-

$^1/_4$ Vertex-trichion distance (v-tri)

$^1/_4$ Trichion-exocanthion distance (tri-ex)

$^1/_4$ Exocanthion-subnasale distance (ex-sn)

$^1/_4$ Subnasale-gnathion distance (sn-gn)

(see Figure 7.10)

(b) In addition, Broadbent and Matthews also state that, in the ideal face, the interoccular distance should be equal to the width of the eye (see Figure 7.11) or:-

$$\text{en-en} = \frac{\text{Rt.en-ex} + \text{Left en-ex}}{2}$$

(c) Loomis (1958) postulated that the lower part of the face (sn-gn distance) should fall into two equal parts:-

$$\text{sn-gn} = \begin{matrix} \text{sn-li} & ^1/_2 & = \text{Subnasale-labiale inferius distance} \\ \text{li-gn} & ^1/_2 & = \text{Labiale inferius-gnathion distance} \end{matrix}$$

or sn-li = li-gn

(see Figure 7.12)

The extra measurements necessary for testing the various canons of beauty are shown in Table 7.1. Other measurements which were used are shown in Table 7.2. These have already been used in the first part of this investigation and are described in detail in Chapter 3.

Not only was it necessary to measure the magazine model sample but these measurements had also to be made on the adults of the British and Tanzanian samples so that direct comparison could be made. Since the magazine models were unscaled, the measurements taken could not be converted to absolute and in consequence the measurements themselves could not be compared directly. Angles and relationships, however, which were independent of scaling could be directly compared.

Table 7.1 List of extra measurements to be taken
(all from front view)

Measurement Number	Between these landmarks	For which test
I	Vertex-gnathion (v-gn)	Harmonic analysis
II	Vertex-exocanthion (v-ex)	" "
III	Trichion-exocanthion (tri-ex)	" " and $^1/4$'s of face
IV	Exocanthion-gnathion (ex-gn)	Harmonic analysis
V	Pronasale-gnathion (pro-gn)	" "
VI	Exocanthion-pronasale (ex-pro)	" "
VII	Exocanthion-stomion (ex-sto)	" "
VIII	Stomion-gnathion (sto-gn)	" "
IX	Trichion-superciliare (tri-sci)	$^1/3$rds of face
X	Superciliare-subnasale (sci-sn)	" " "
XI	Subnasale-gnathion (sn-gn)	" " " and $^1/4$'s of face
XII	Subnasale-stomion (sn-sto)	$^1/3$rds of face
XIII	Vertex-trichion (v-tri)	" " " and $^1/4$'s of face
XIV	Vertex-superciliare (v-sci)	$^1/3$rds of face
XV	Exocanthion-subnasale (ex-sn)	$^1/4$'s of face
XVI	Subnasale-labiale inferius (sn-li)	$^1/2$'s of low.face
XVII	Labiale inferius-gnathion (li-gn)	" " " "

Table 7.2 List of measurements used in tests of the theories of the ideal face already described in Chapter 3

Measurement Number(Chpt.3)	Name of Measurement	Landmarks Used	Test used For
Front View			
1	Bizygomatic Diam.	zy-zy	Harmonic Analysis
3	Nasal Breadth	al-al	Harmonic Analysis
4	Inter-occular Dist.	en-en	1/4's of face
5	Bioccular Diameter	ex-ex	Harmonic Analysis
6	Mouth Width	ch-ch	Harmonic Analysis
12	Rt.Eye Fissure Width	en-ex	1/4's of face
13	Lt.Eye Fissure Width	en-ex	1/4's of face
Profile View			
26	Nasal Base Angle	n-sn and vert	Angs. Rel.Fac.Plane
27	Upper Lip Angle	sn-ls & vert.	Angs. Rel.Fac.Plane
28	Chin Angle	sn-pg & vert.	Angs. Rel.Fac.Plane
31	Protraction/Retraction of Frontal Region from Vertical		Fac.Plane Alignment
32	Protraction/Retraction of Nasal Region from Vertical		Fac.Plane Alignment
33	Protraction/Retraction of Labial Region from Vertical		Fac.Plane Alignment
34	Protraction/Retraction of Mandibu--lar Region from Vertical		Fac.Plane Alignment

7.3(vi) - Indices Computed

Since the angles used in 7.3(iv) and the relationships in 7.3(iii) are independent of scaling it was possible to compare them directly with those taken for the samples from Great Britain and Tanz--ania. As two other angles, the Nasal Base Angle and the Frontal Reces--sion Angle had already been measured for the samples above I decided to measure these for the magazine model sample and include these along with the other relationship, the Nasal Wing Septum Relationship, in the analysis of the differences and similarities of the magazine model sample with the others.

The rest of the measurements taken were used to compute indices for the tests described in Sections 7.3(i), 7.3(ii) and 7.3(v).

(a) From Section 7.3(i)

Harmonic analysis of the face and determination of the Golden Number

The indices to be computed are:-

$$\frac{\text{v-gn}}{\text{zy-zy}} = \frac{\text{Vertex-gnathion distance}}{\text{Bizygomatic diameter}} = \phi$$

$$\frac{\text{v-ex}}{\text{tri-ex}} = \frac{\text{Vertex-exocanthion distance}}{\text{Trichion-exocanthion distance}} = \phi$$

$$\frac{\text{ex-gn}}{\text{prn-gn}} = \frac{\text{Exocanthion-gnathion distance}}{\text{Pronasale-gnathion distance}} = \phi$$

$$\frac{\text{tri-ex}}{\text{ex-prn}} = \frac{\text{Trichion-exocanthion distance}}{\text{Exocanthion-pronasale distance}} = \phi$$

$$\frac{\text{ex-sto}}{\text{ex-prn}} = \frac{\text{Exocanthion-stomion distance}}{\text{Exocanthion-pronasale distance}} = \phi$$

$$\frac{\text{prn-gn}}{\text{sto-gn}} = \frac{\text{Pronasale-gnathion distance}}{\text{Stomion-gnathion distance}} = \phi$$

$$\frac{\text{zy-zy}}{\text{ex-ex}} = \frac{\text{Bizygomatic diameter}}{\text{Bioccular diameter}} = \phi$$

$$\frac{\text{ex-ex}}{\text{ch-ch}} = \frac{\text{Bioccular diameter}}{\text{Mouth width}} = \phi$$

$$\frac{\text{ch-ch}}{\text{al-al}} = \frac{\text{Mouth width}}{\text{Nasal Breadth}} = \phi$$

These indices according to the theory should all be equal and come to 1.618 which is the value for ϕ, the Golden Number.

(b) From Section 7.3(ii)

Equal thirds of the face

$$\frac{\text{tri-sci}}{\text{sci-sn}} = \frac{\text{Trichion-superciliare distance}}{\text{Superciliare-subnasale distance}} = 1$$

$$\frac{\text{sci-sn}}{\text{sn-gn}} = \frac{\text{Superciliare-subnasale distance}}{\text{Subnasale-gnathion distance}} = 1$$

$$\frac{\text{tri-sci}}{\text{sn-gn}} = \frac{\text{Trichion-superciliare distance}}{\text{Subnasale-gnathion distance}} = 1$$

According to the theory all the indices should be equal.

Also:

$$\frac{\text{sn-gn}}{\text{sn-sto}} = \frac{\text{Subnasale-gnathion distance}}{\text{Subnasale-stomion distance}} = 0.3333$$

According to the theory this index should equal $^1/3$rd or 0.3333 as should the index below.

$$\frac{\text{v-sci}}{\text{v-tri}} = \frac{\text{Vertex-superciliare distance}}{\text{Vertex-trichion distance}} = 0.3333$$

(c) From Section 7.3(v)

Equal quarters of the face

$$\frac{\text{v-tri}}{\text{tri-ex}} = \frac{\text{Vertex-trichion distance}}{\text{Trichion-exocanthion distance}} = 1$$

$$\frac{\text{ex-sn}}{\text{sn-gn}} = \frac{\text{Exocanthion-subnasale distance}}{\text{Subnasale-gnathion distance}} = 1$$

Each of the above indices should equal 1.0000.

Also:

$$\frac{\text{en-en}}{\left(\frac{\text{Rt. en-ex + Lt. en-ex}}{2}\right)} = \frac{\text{Interoccular distance}}{\text{Eye Fissure width}} = 1$$

This should equal 1.0000 as should :-

$$\frac{\text{sn-li}}{\text{li-gn}} = \frac{\text{Subnasale-labiale inferius distance}}{\text{Labiale inferius-gnathion distance}} = 1$$

or

$$\frac{\text{sn-gn}}{\text{sn-li}} = \frac{\text{Subnasale-gnathion distance}}{\text{Subnasale-labiale inferius distance}} = 0.5000$$

This should equal 0.5000.

7.3(vii) Other Measurements and indices computed

Since I had measured a great many distances for all of the individuals in the British and Tanzanian samples I decided to carry out the same measurements on the magazine model samples as well as those described above. This would allow me to compute indices using front and profile views individually but not combined. I would also be able to carry out Factor Analysis and Discriminant Function Analysis on these indices, along with the measurements of angles and relationships, which would determine if the magazine model sample was significantly different from the others and, if so, which particular variables measured were contributing most to these differences.

7.4 - The sample of magazine models

Since the purpose of this section of the study was to investi--gate whether or not the faces regarded as being beautiful today come closer to the classical formulae for the ideal face than do samples of average people, it was obviously necessary to obtain a series of faces regarded as being beautiful by the general public. The other purpose of this section was to see if the sample of 'beautiful' faces differed sig--nificantly from the other samples from Great Britain and Tanzania and if so what caused them to be different.

The sample of 'beautiful' faces was collected from faces printed in popular womens magazines, hairstyling journals, beauty maga--zines and other forms of the popular press. The faces were selected from articles or advertisements where it was obviously apparent that they had been used to convey the fact that they were indeed 'beautiful' faces in the eyes of the photographer, editor and the person who was to read the magazine.

Faces were only selected which appeared to be totally full--face or lateral, profile views and to be orientated in the required Frankfort Plane. These proved to be very hard criteria to achieve and from the thousands of photographs examined relatively few actually were selected (see Table 7.3). This method of selection of this particular sample was perhaps the least scientific aspect of the whole of the study and in the analysis of data I make allowances for this fact. Nevertheless, my reasoning was that, if the face appeared to be in the correct plane and was not exactly orientated, then this pose had been chosen to flatter the face more e.g. by reducing nasal length by having the face slightly inclined upwards (see Farkas, 1982; Dickason and Hanna, 1976). I, therefore, took the face for what it appeared to be as portrayed in the photograph which may, or may not, have been a truly accurate representation of the actual face. The magazine model sample could, therefore, be better described as a sample of faces of models as they appear to be in the magazines.

Table 7.3 Magazine Model Sample

SEX	FRONT VIEW	PROFILE VIEW	TOTAL
MALE	18	4	22
FEMALE	130	40	170

Various other problems arose because of this method of obtain--ing a sample. Some landmarks were not always easy to determine: the Vertex and Trichion were often difficult or impossible to locate because of the hairstyle; the Superciliare was difficult to find where eyebrows had been plucked and shaded in. In the latter case I took the new level as the superciliare point because this is where the make-up artist wish--ed it to appear to be to make the face look most attractive. Make-up in general has the effect of changing the appearance of the face (see Chapple and Stephenson, 1970) as has the use of different types of light--ing (see Dickason and Hanna, 1976; Morello et al.,1977). Neither of these techniques would be acceptable in straight forward photogrammetry of the face but for this part of the study I allowed it because I be--lieved the photographer had used it to show the face in its most beauti--ful aspect.

None of the faces had any scaling and so could not be con--verted to absolute measurements. The readings obtained could, therefore, not be compared directly with the samples from Great Britain and Tanzania, apart from the angles and relationships which are independant of scaling. By computing indices, however, using front and profile views independent--ly it was possible to produce values which could be compared directly.

The numbers of individuals in the magazine model sample are shown in Table 7.3. They are divided up be sex and view i.e. Male front, Male profile, Female front and Female profile.

As can be seen from Table 7.3 the number of male photographs which were suitable for analysis was disappointingly low especially male profile subjects. They are, therefore, included for completeness but the sample number was unfortunately to low to use. The female views were, therefore, concentrated on which was the main purpose from the out--set.

7.5 - Results

(i) For the harmonic analysis of the face and determination of the Golden Number all of the indices should be equal and come to 1.618. The results are shown in Table 7.4. From the table it can be seen that no value comes to exactly 1.618 and the values are not identical for each index but vary from 1.442 to 1.968 (0.526 variance) for magazine models - male, 1.445 to 1.978 (0.533 variance) for female magazine models, 1.414 to 2.348 (0.934 variance) for British males and 1.443 to 2.445 (1.002 variance) fro Brit--ish females. The magazine models have, thus, the least variance and for mean values of the indices the male magazine models are closer to 1.618 having a mean of 1.701 than the British male with a mean of 1.713. The British females, however, are closer to 1.618 with their mean of 1.723 than the female magazine models, mean 1.738. The male magazine models are closer to the Golden Number on 5 out of the 9 occassions, the British male sample being closer on the other 4. Of these 9 there are highly significant differences on 6. The female magazine models are closer to the Golden Number on 4 occassions and the female British on the other 5. There are 7 highly significant differences and one significant difference here. These results do not prove the Golden Number for Harmonic analysis to hold true.

Table 7.4 Results for Harmonic Analysis

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE (MANN - WHITNEY U TEST)			
	MALE MAG.MODS n= 20	FEMALE MAG.MODS n= 130	MALE BRITISH n= 99	FEMALE BRITISH n= 70	MALE MAG.MODS. V BRITISH		FEMALE MAG.MODS. V BRITISH	
v - gn / zy - zy	1.828 ± 0.127	1.790 ±0.122	1.696 ±0.119	1.663 ±0.085	0.0003	1%	0.0000	1%
v - ex / tri - ex	1.968 ± 0.217	1.947 ±0.339	1.608 ±0.218	1.594 ±0.189	0.0000	1%	0.0000	1%
ex - gn / prn - gn	1.510 ± 0.092	1.550 ±0.106	1.414 ±0.101	1.421 ±0.093	0.0002	1%	0.0000	1%
tri - ex / ex- prn	1.805 ± 0.250	1.978 ±0.391	2.348 ±0.462	2.445 ±0.551	0.0000	1%	0.0000	1%
ex - sto / ex - prn	1.820 ± 0.180	1.791 ±0.164	2.027 ±0.274	2.005 ±0.237	0.0026	1%	0.0000	1%
prn - gn / sto - gn	1.698 ± 0.075	1.743 ±0.100	1.690 ±0.140	1.718 ±0.127	0.5650	-	0.0103	5%
zy - zy / ex - ex	1.442 ± 0.083	1.445 ±0.066	1.485 ±0.087	1.461 ±0.069	0.0891	-	0.0504	-
ex - ex / ch - ch	1.679 ± 0.176	1.887 ±0.164	1.717 ±0.170	1.760 ±0.157	0.5282	-	0.0000	1%
ch - ch / al - al	1.562 ± 0.178	1.514 ±0.138	1.435 ±0.164	1.443 ±0.138	0.0033	1%	0.0006	1%

7.5 (ii)

For the equal thirds of the face test the first three indices should come to 1.000 and the fourth and fifth should equal 0.3333. The results are shown in Table 7.5. The means for the first three indices shows the male and female British to be closer to 1.000 than the magazine models. In two out of three cases the British male is closer to zero than the magazine models. The British female is likewise closer to zero than the female magazine model on 2 out of 3 occassions. One result out of three is highly significant for the males and 2 out of 3 for the females.

Table 7.5 "Thirds of Face" Test Results

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE MANN - WHITNEY U TEST			
	MALE MAG.MODS	FEMALE MAG.MODS	MALE BRITISH	FEMALE BRITISH	MALE MAG. MODS. V MALE BRIT.		FEMALE MAG. MODS. V FEMALE BRIT.	
tri - sci / sci - sn	1.391 ± 0.232	1.400 ±0.260	1.301 ±0.227	1.343 ±0.029	0.1490	-	0.1176	-
sci - sn / sn - gn	1.074 ± 0.136	1.168 ±0.136	0.980 ±0.014	1.065 ±0.017	0.0061	1%	0.0000	1%
tri - sci / sn - gn	1.317 ± 0.287	1.206 ±0.264	1.341 ±0.263	1.278 ±0.026	0.6719	-	0.0093	1%
sn - gn / sn - sto	0.315 ± 0.035	0.331 ±0.028	0.308 ±0.004	0.317 ±0.044	0.6319	-	0.0945	-
v - sci / v - tri	0.316 ± 0.018	0.325 ±0.006	0.310 ±0.024	0.318 ±0.036	0.5217	-	0.0817	-
Means	1.261 ± 0.316	1.258 ±0.328	1.207 ±0.309	1.229 ±0.318				

For the last two indices the female magazine models are closer to 0.333 than the British females (0.328 compared to 0.318 re--spectively) and the male magazine models (mean 0.316) are closer to 0.333 than the British males (mean 0.309). No significant differences are shown for any results.

7.5(iii)

Alignment of features to facial plane is found by scoring whether regions cross (protraction), touch (vertical), or are behind (retraction). For perfect face all regions; frontal, nasal, labial and mandibular should be vertical. Results are shown in Table 7.6. As can be seen there is only one result showing significant difference (at the 1% level) between female magazine models and female British for the Labial Region Vertical Relationship.

In two cases out of four there are a greater proportion of male magazine models with a region touching the vertical than British males. These regions are the Labial and Mandibular Regions. In the Frontal and Nasal Regions the British males have a greater percentage in the vertical. In three cases out of four there is a greater percent--age of British females than magazine female models in the vertical plane. In the remaining region, the nasal, the female magazine models have more.

Table 7.6 Vertical Relationships of Facial Profile

VARIABLES	PERCENTAGE FREQUENCIES				LEVELS OF SIGNIFICANCE MANN-WHITNEY U TEST			
	MALE MAG.MODS	FEMALE MAG.MODS	MALE BRITISH	FEMALE BRITISH	MALE MAG. MODS. V MALE BRIT.		FEMALE MAG. MODS. V FEMALE BRIT.	
Frontal								
PRO.	75.0	70.0	52.5	61.4				
VERT.	0.0	10.0	4.0	17.1	0.3656	-	0.3119	-
RET.	25.0	20.0	43.4	21.4				
Nasal								
PRO.	0.0	2.5	2.0	2.9				
VERT.	0.0	2.5	1.0	1.4	0.9067	-	0.7371	-
RET.	100.0	95.0	97.0	95.7				
Labial								
PRO.	75.0	72.5	42.4	35.7				
VERT.	25.0	5.0	8.1	20.0	0.4476	-	0.002	1%
RET.	0.0	22.5	49.5	44.3				
Mandibular								
PRO.	25.0	2.5	6.1	8.6				
VERT.	25.0	5.0	11.2	8.6	0.8910	-	0.7387	-
RET.	50.0	92.5	81.6	82.9				

7.5(iv)

Angles of lower face in relation to the vertical is found by measuring the upper lip and chin angles and seeing if those in the models come nearer to 90 degrees, and if so, if the difference is significant. The results are shown in Table 7.7. As can be seen from the table the female British approach the vertical for both variables closer than the female magazine models. For the Upper lip Angle the difference is highly significant. In the males the British approach the vertical more close--ly than the models for the Upper Lip Angle but the situation is reversed for the Chin Angle where the magazine models are closest. None of these differences are significant.

Table 7.7 Angles of Lower Face in Relation to Vertical

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE			
	MALE MAG.MODS	FEMALE MAG.MODS	MALE BRITISH	FEMALE BRITISH	MALE MODS. MALE BRIT.		FEMALE MODS. FEMALE BRIT.	
Upper Lip Angle	7.500 ± 6.137	8.175 ±10.799	2.051 ±9.111	-2.457	0.2419	-	0.0000	1%
Chin Angle	-4.750 ±7.932	-11.250 ±5.102	-11.133 ± 5.177	-11.057 ± 5.286	0.0904	-	0.9577	-

7.5(v)

Equal quarters of the face are determined using the indices shown in Table 7.8 which also contains the results. The first four indices should equal 1.0000 the last one should equal 0.500. As can be seen from Table 7.8 the male magazine models come closer to 1.0000 in three out of the first four indices. Of these the first and third show highly significant differences. The female magazine models show values closer to 1.0000 than the British females in three out of four cases. Two out of four are highly significant differences.

In the final index both the male and female magazine models come closer to 0.500 than do the British. The female difference is highly significant.

Table 7.8 Indices for Equal Thirds of the Face Analysis

VARIABLES	MEANS AND STANDARD DEVIATIONS				LEVELS OF SIGNIFICANCE			
	MALE MODS.	FEMALE MODS.	MALE BRITISH	FEMALE BRITISH	MALE MODS. BRITISH MA.		FEMALE MODS. BRITISH FE.	
v - tri / tri - ex	1.231 ±0.432	1.173 ±0.571	1.817 ±0.682	1.261 ±0.217	0.0056	1%	0.8726	-
ex - sn / sn - gn	1.986 ±0.981	2.221 ±0.627	2.017 ±0.271	1.891 ±0.871	0.9571	-	0.0012	1%
In.Occ.Dis / EyeFis.Wth	1.112 ±0.721	1.261 ±0.817	1.651 ±0.008	1.662 ±0.621	0.0001	1%	0.0002	1%
sn - li / li - gn	1.860 ±0.261	1.217 ±0.004	1.371 ±0.127	1.512 ±0.002	0.8716	-	0.5721	-
sn - gn / sn - li	0.568 ±0.005	0.572 ±0.007	0.674 ±0.216	0.712 ±0.471	0.812	-	0.0000	1%

7.6-Discriminant Function Analysis

A discriminant function analysis was carried out for the magazine models, British and Tanzanian population samples. The functions produced and the variables they contain are shown in summary in Table 7.9 and in detail in Appendix 7.

Table 7.9 Standardized Discriminant Function Coefficients

FUNCTION 1

Mouth-Nose Width Index	2.67360
Bioccular-Mouth Width Index	2.42765
Nasal Breadth Index	-1.46037

FUNCTION 2

Thirds of Face Index	0.65053
Eye Fissure Index	0.43747
Lip Index	-0.26210

FUNCTION 3

Occular Index	8.19380
Inter-Occular Width Index	-8.01731
Bioccular Width Index	5.16928
Ear Protrusion Index	-0.52772

The three functions and the percentage of variance each con--tains is shown in Table 7.10. Function 1 contains 84.39% of the total variance, Function 2 accounts for 13.50%. Between them these two func-

-tions are used to produce the scatterplots shown in Figures 7.20 (a - g).

Table 7.10

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGENVALUE	PERCENT OF VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION
1*	2.34825	84.39	84.39	0.8374596
2*	0.37575	13.50	97.90	0.5226140
3*	0.05852	2.10	100.00	0.2351213

AFTER FUNCTION	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFICANCE
0	0.2050894	236.85	45	0.0000
1	0.6866915	56.193	28	0.0012
2	0.9447180	8.5019	13	0.8094

* MARKS THE 3 CANONICAL DISCRIMINANT FUNCTION(S)

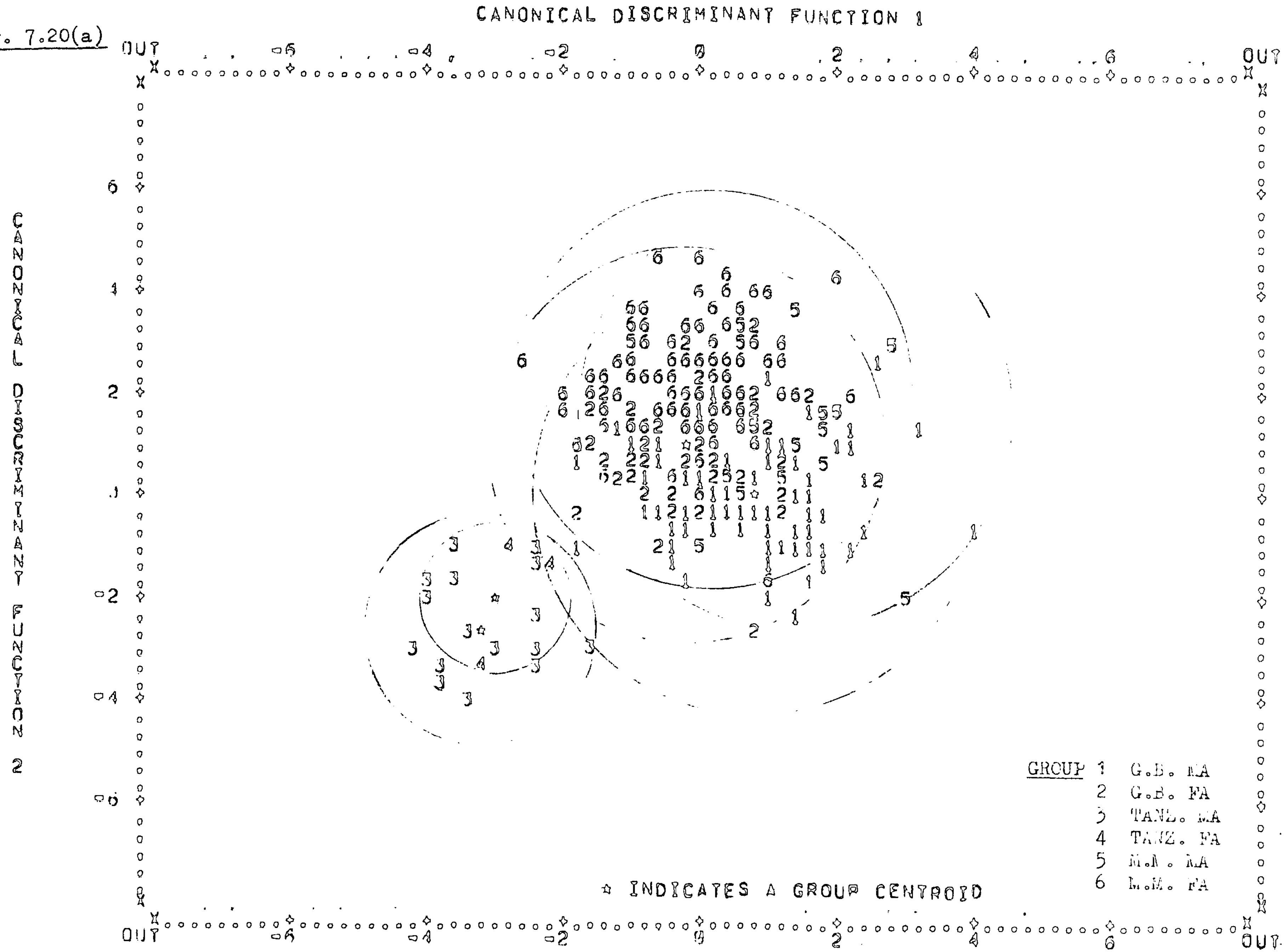
TO BE USED IN THE REMAINING ANALYSIS.

Table 7.11

F STATISTICS AND SIGNIFICANCES BETWEEN PAIRS OF GROUPS
EACH F STATISTIC HAS 15 AND 142.0 DEGREES OF FREEDOM.

GROUP	1	2	3
2	3.5609 0.0000		
3	18.859 0.0000	16.622 0.0000	
4	4.0758 0.0000	4.0046 0.0000	0.58166 0.7992

Fig. 7.20(a)



CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2
OUT
-6
-4
-2
0
2
4
6
OUT
☆ INDICATES A GROUP CENTROID
GROUP
1 G.B. MA
2 G.B. FA
3 TANZ. MA
4 TANZ. FA
5 M.M. MA
6 M.M. FA

Fig. 7.20(b)

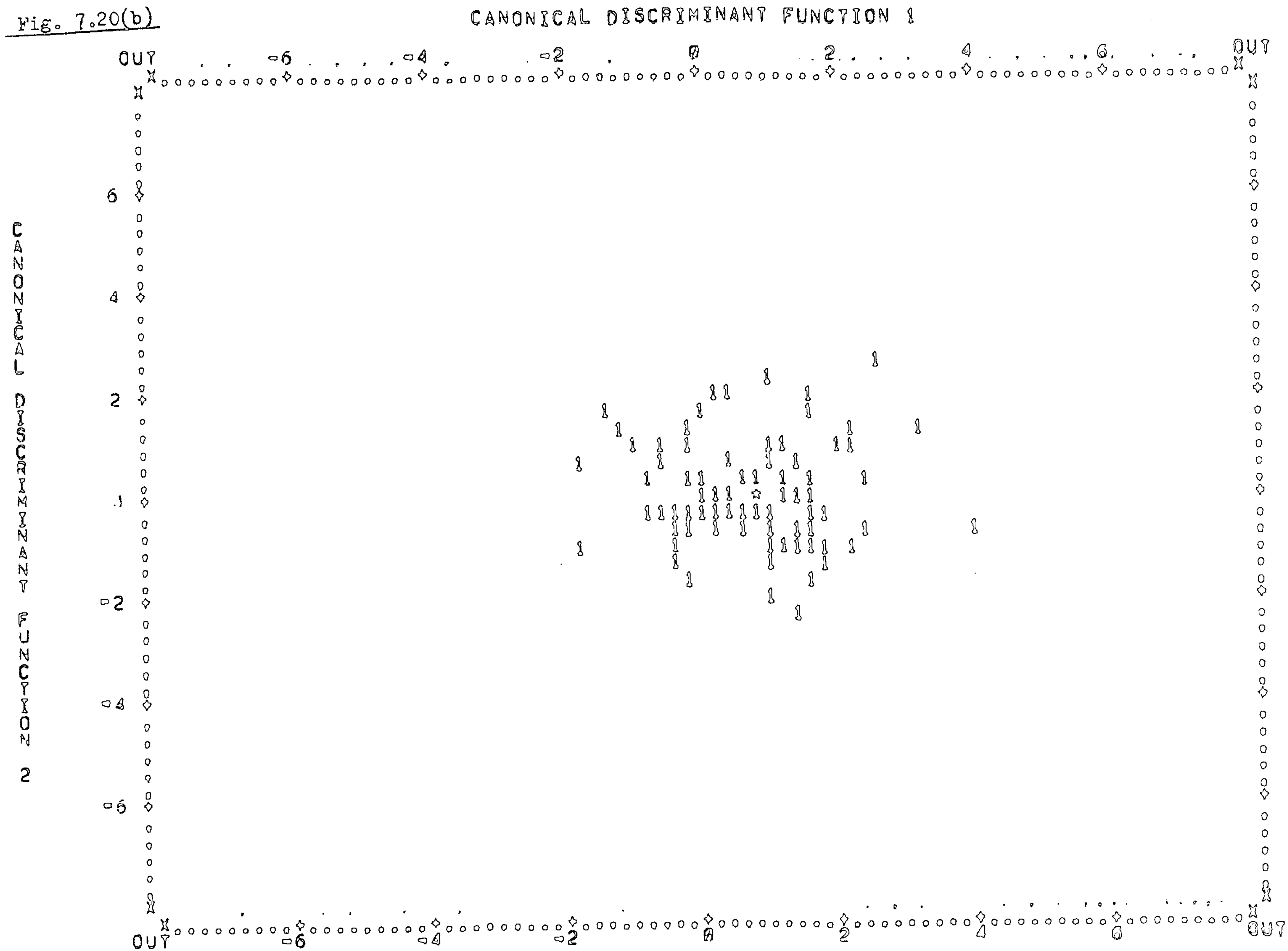

CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2
OUT
-6
-4
-2
0
2
4
6
OUT

Fig. 7.20(c)

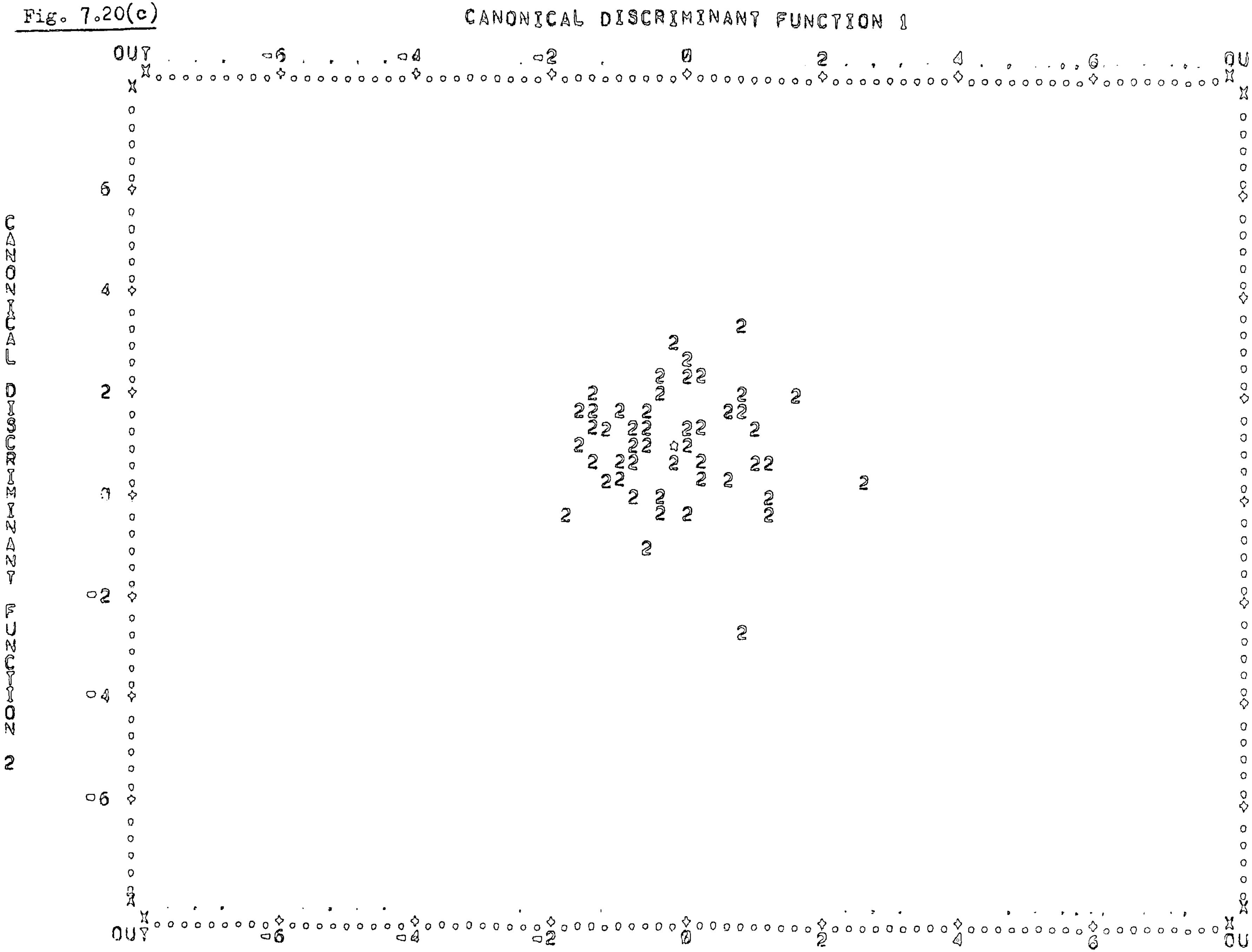

CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2
OUT
-6
-4
-2
0
2
4
6
OUT

Fig. 7.20(d)

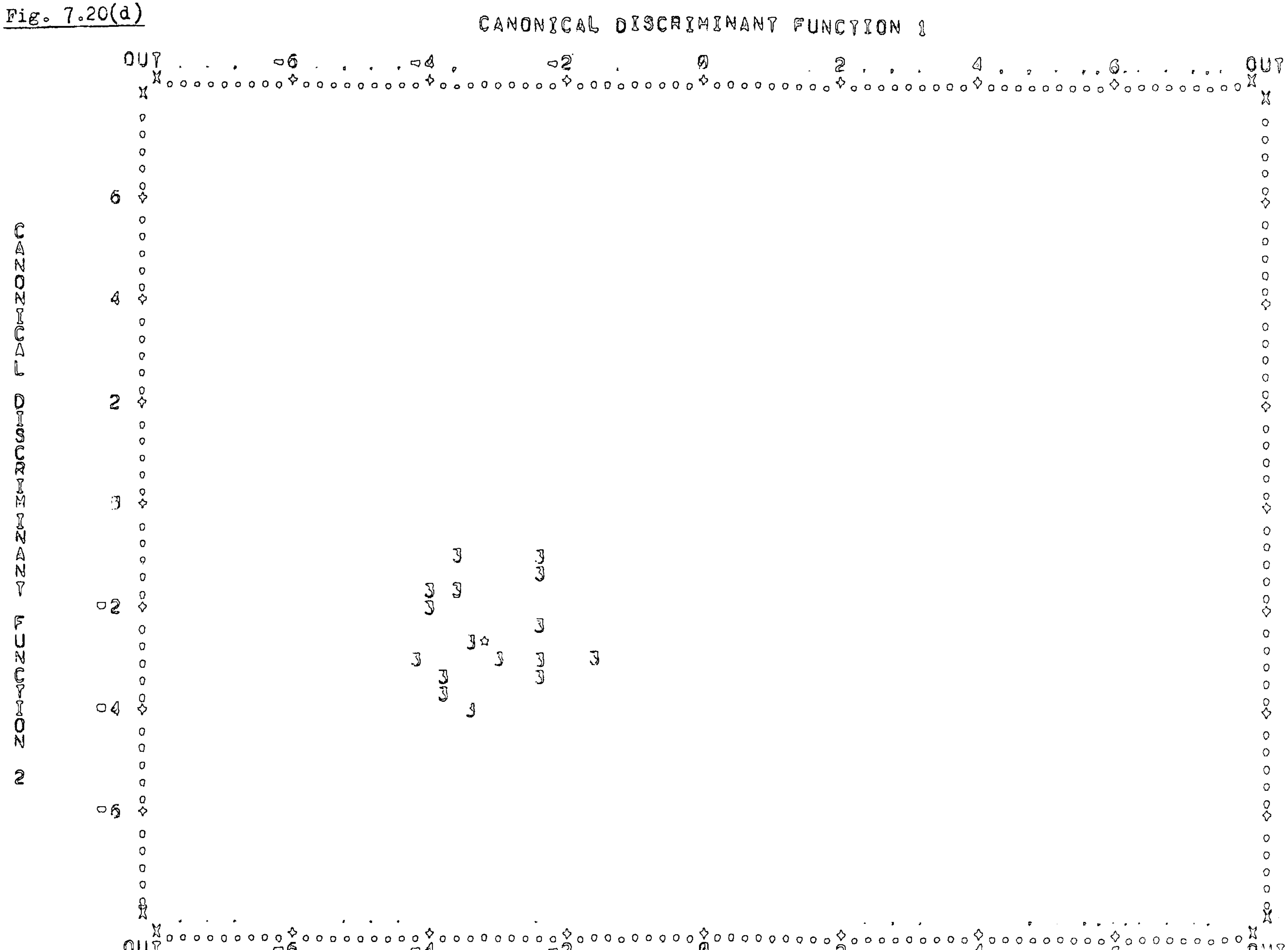

CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2
OUT
-6
-4
-2
0
2
4
6
OUT

Fig. 7.20(e)

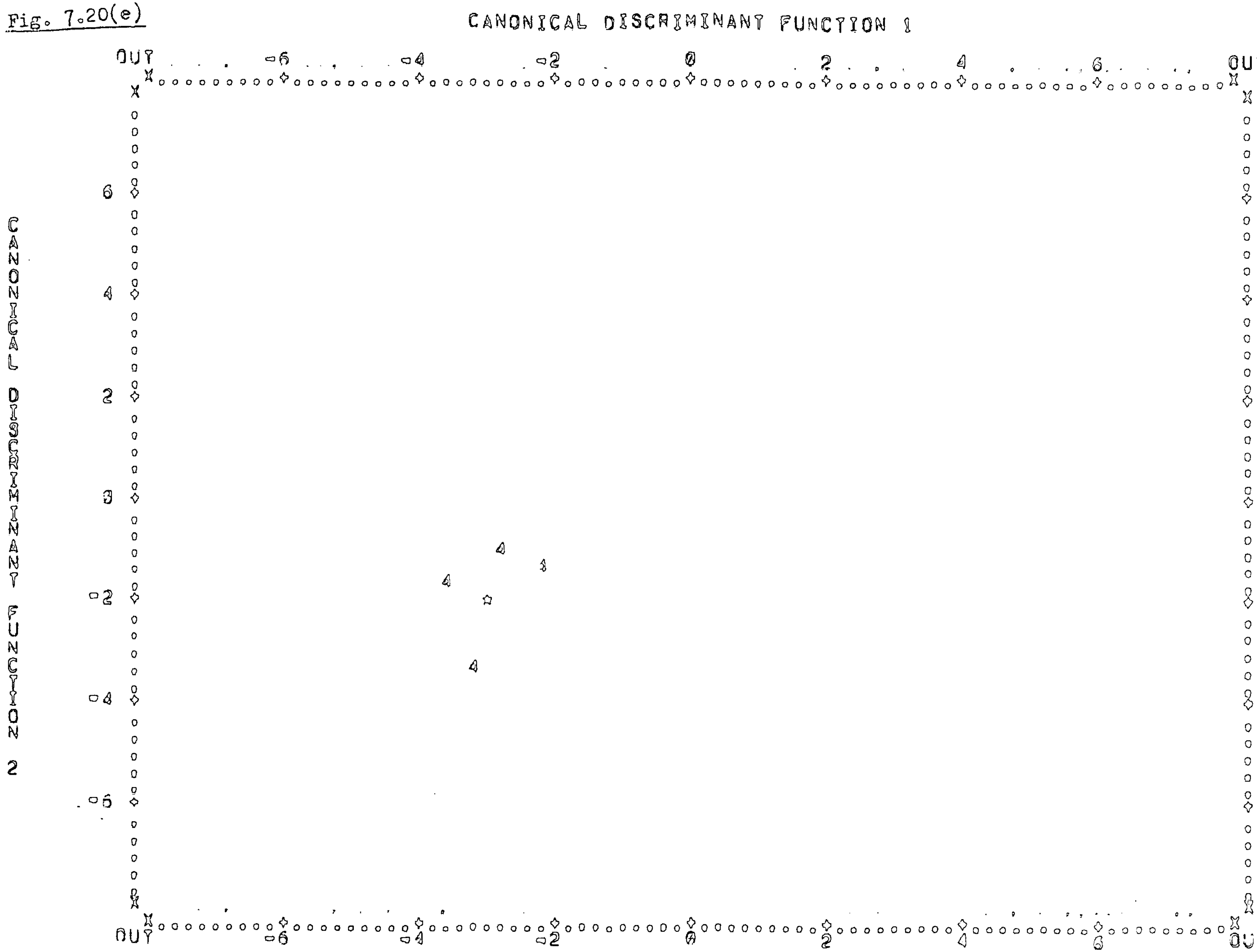

CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2
OUT
-6
-4
-2
0
2
4
6
OUT

Fig. 7.20(f)

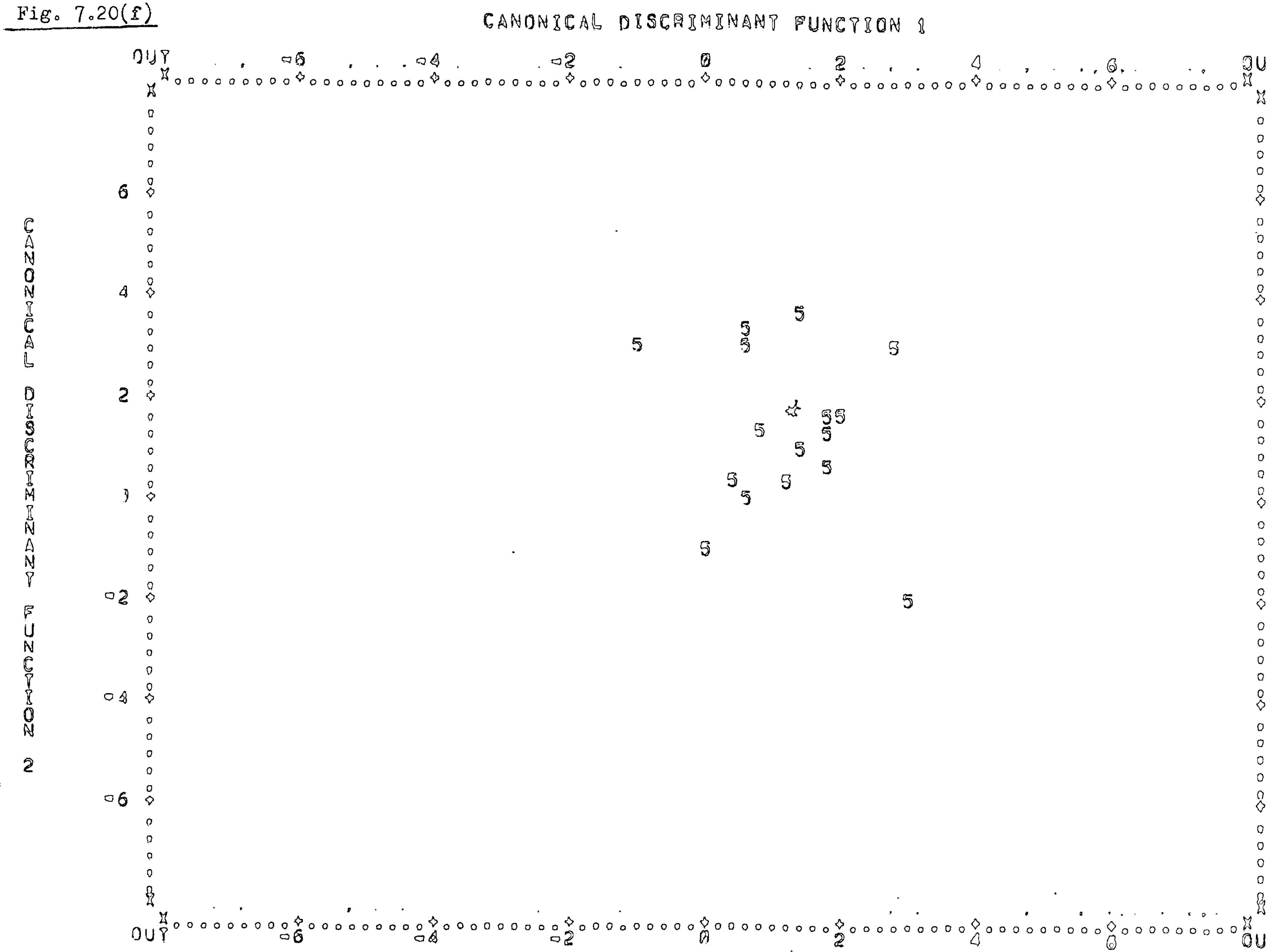
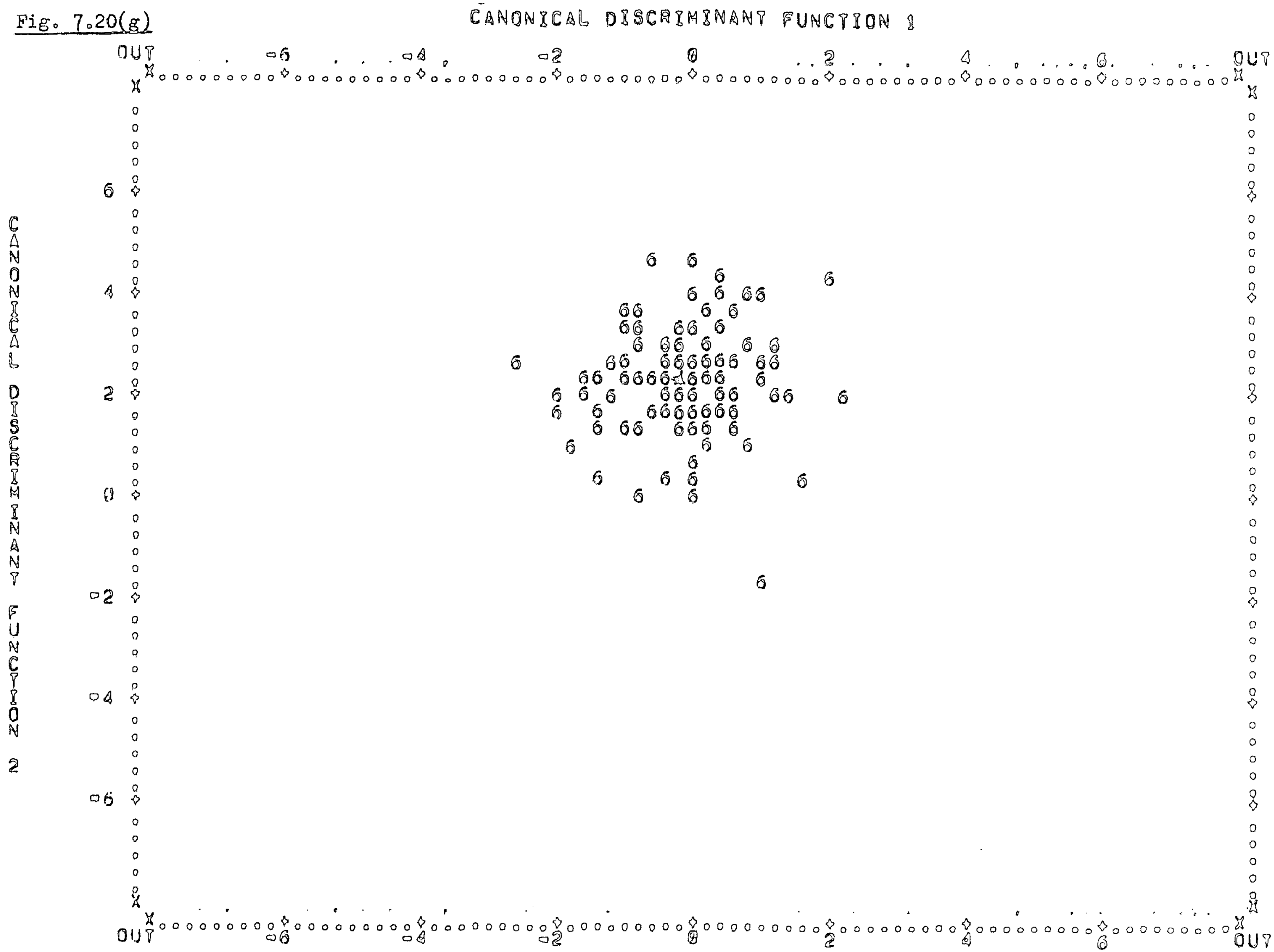

CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2
OUT
-6
-4
-2
0
2
4
6
OUT
6
4
2
0
-2
-4
-6

Fig. 7.20(g)


CANONICAL DISCRIMINANT FUNCTION 1
CANONICAL DISCRIMINANT FUNCTION 2
OUT
-6
-4
-2
0
2
4
6

It can be seen from Figure 7.20(a) that the Tanzanian male and female adults (Groups 3 and 4) are well distanced from the British and magazine models. The magazine models form a cluster very close to the British, slightly overlapping but with centroids removed. As Table 7.11 shows the differences between the group centroids are all highly significant.

Table 7.12 shows the results of re-classifying grouped cases. The percentage of correctly grouped cases is 45.76%. This is low due to the fact that the British and magazine models overlap to a large extent.

Table 7.12 CLASSIFICATION RESULTS -

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2	3	4
1	95	75 78.9%	19 20.0%	1 1.1%	0 0.0%
2	56	13 23.2%	43 76.8%	0 0.0%	0 0.0%
3	17	0 0.0%	0 0.0%	14 82.4%	3 17.6%
4	4	0 0.0%	0 0.0%	1 25.0%	3 75.0%
5	16	10 62.5%	6 37.5%	0 0.0%	0 0.0%
6	107	8 7.5%	99 92.5%	0 0.0%	0 0.0%

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 45.76%

A discriminant function analysis was carried out between British male and female subjects and magazine models both male and female. The variable chosen and their discriminant function coefficients are shown in Table 7.13. These variables were used to plot histograms as shown in Figures 7.21 (a-e). As can be seen from Figure 7.21 (a) the British subjects are towards the left and the magazine models to the right although there is some overlap.

Table 7.13 Canonical Discriminant Function Coefficients

FUNCTION 1

Ear Protrusion Index	6.690473
Eye Fissure Index	0.458644
Bioccular Width Index	-4.527155
Golden Proportion Index V	-2.277507
Bioccular-Mouth Width Index	1.276664
Thirds of Face Index	7.339872
Mouth Index	3.848840

The classification results are shown in Table 7.14

Table 7.14

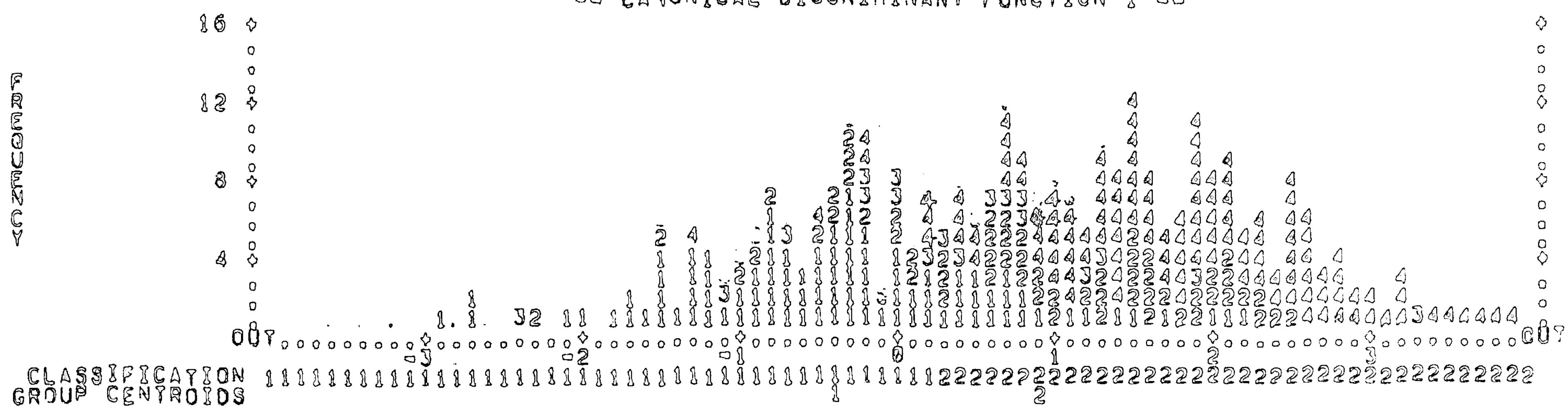
CLASSIFICATION RESULTS -

ACTUAL GROUP		NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2
GROUP	1	95	70 73.7%	25 26.3%
GROUP	2	59	16 27.1%	43 72.9%
GROUP	3	18	7 38.9%	11 61.1%
GROUP	4	123	4 3.3%	119 96.7%

Percentage of grouped cases correctly classified = 76.1%

Fig. 7.21(a) ALL-GROUPS STACKED HISTOGRAM

-- CANONICAL DISCRIMINANT FUNCTION 1 --



Key to Groups

GROUP 1 = G.B. MA
2 = G.B. FA
3 = M.M. MA
4 = M.M. FA

Fig. 7.21(b) HISTOGRAM FOR GROUP 1

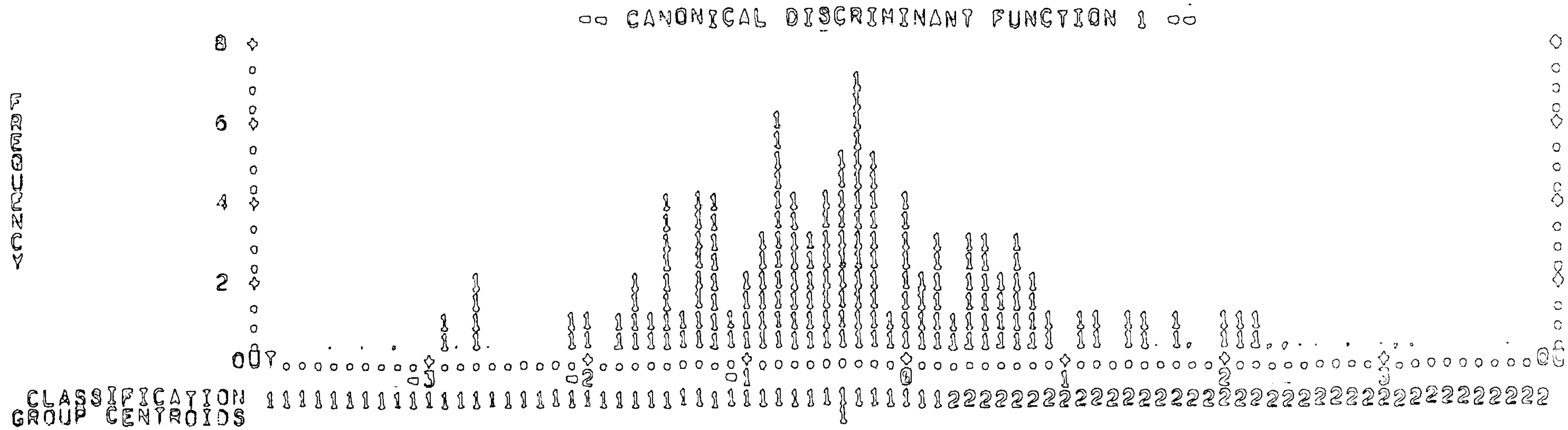


Fig. 7.21(c) HISTOGRAM FOR GROUP 2

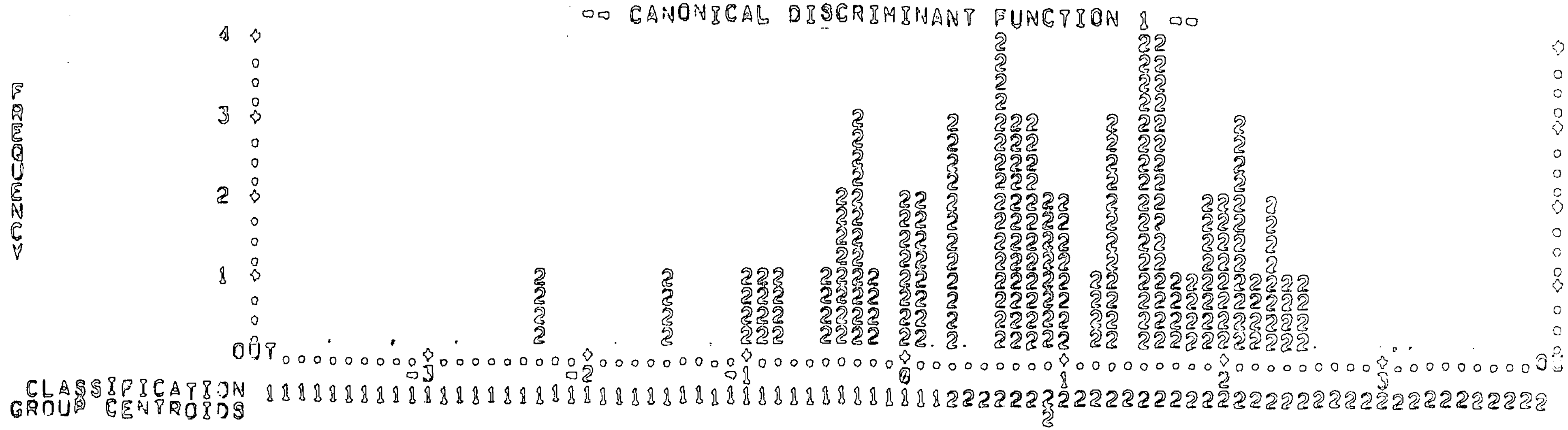


Fig. 7.21(d) HISTOGRAM FOR GROUP 3

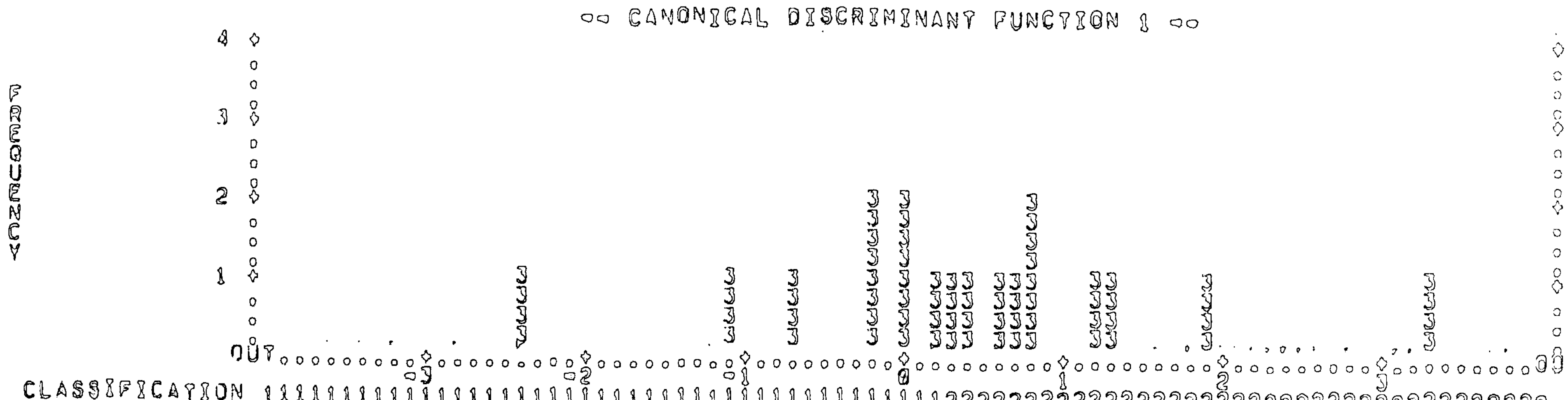
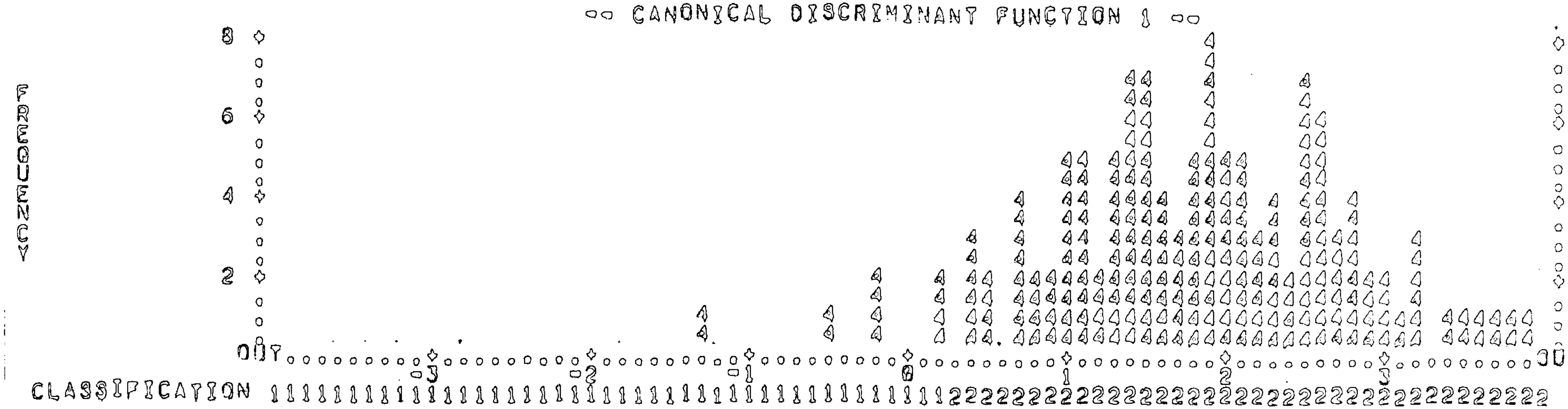


Fig. 7.21(e) HISTOGRAM FOR GROUP 4



CHAPTER EIGHT - CONCLUSIONS

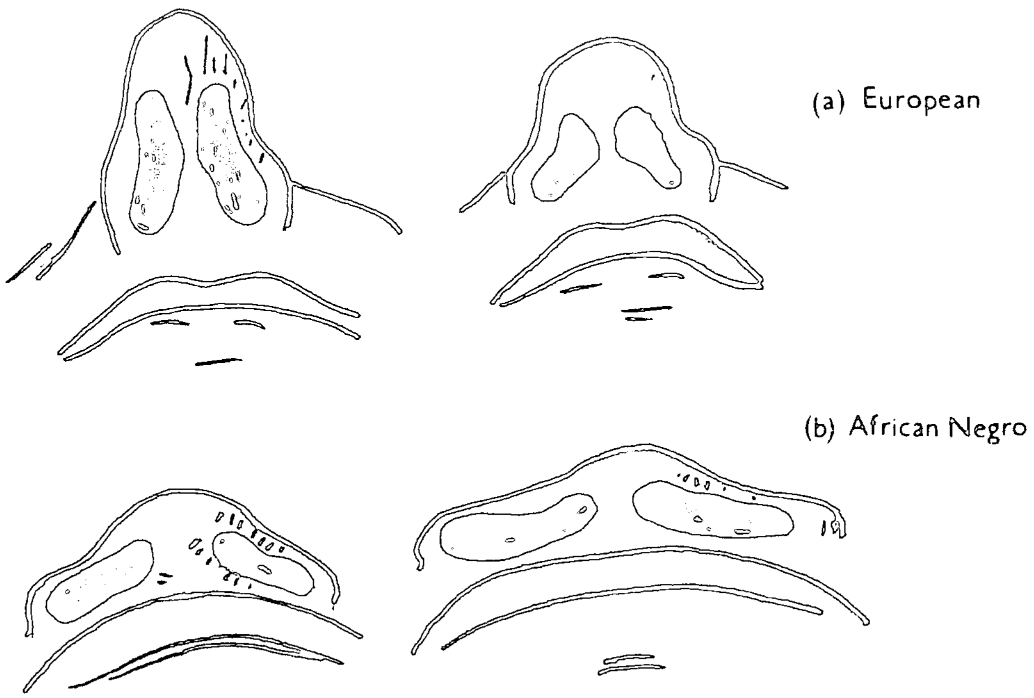
From the results presented in Chapter 6 and Chapter 7 various conclusions can be drawn related to the aims and objective set out in Chapter 1.

First of all, it is possible to discriminate between the populations of Tanzania and Great Britain using the variables taken from facial characteristics. The Tanzanians have, in absolute terms, larger heads and faces on average than the British. This applies in the cases of both males and females. The slope of the foreheads differ with the British having a less sloping forehead than the Tanzanians. The Tanzanian forehead is also relatively small in relation to the height of the upper face than is the case in the British.

Since the faces of the Tanzanians are on average larger than the British the various features and parts of the face are also larger in absolute terms. When taken in relation to the face as a whole different patterns emerge. The relative shapes of the eyes as determined by the Eye Fissure Index and Occular Index are that the eyes of the British adult are longer and narrower than the eyes of the Tanzanian adults whose eyes appear to be shorter and wider relative to the British. The ears, on average, appear to protrude more from the head of the British adult than from that of the Tanzanian adult.

The noses of the Tanzanians and British show perhaps the greatest difference. The breadth of the nose relative to the width of the face is much greater in the Tanzanians than in the British. The British however, have longer noses which protrude more from the profile line both at root and base. The angles of the nose are also different. The Nasal Angle is larger in the British than the Tanzanian. The latter is closer to the profile line. The Nasal Base Angles show differences suggesting that the subnasale is further forward in relation to the nasion in the Tanzanian than in the British. This is further supported by the vertical relationship of the nasal region with significantly more protraction in the Tanzanians. The nose shape here seems to agree with that suggested by Topinard in 1885 (see Figure 8.1).

Figure 8.1 Nasal Types



After Topinard (1885).

The Nasal Wing/Septum Relationship shows a significant difference between the Tanzanian adults. These results do not totally follow the same pattern as those found by Brothwell and Harvey (1965) with the +/+ variety being greater in the Tanzanians than the British (see Figure 8.2) but do in other categories.

For the mouth the British have a wider mouth relative to face width but the Tanzanian have a broader mouth in relation to face height. The Tanzanians lips are relatively larger than the British which are thinner. The Tanzanians upper lip also appears to be larger in relation to the bottom one. The upper lip angle which gives an indication of how much the lips protrude is much greater in the Tanzanians than the British. The pattern seems to fit that described by Martin (1928) (see Figure 8.3).

Figure 8.2(a) from Brothwell and Harvey (1965)

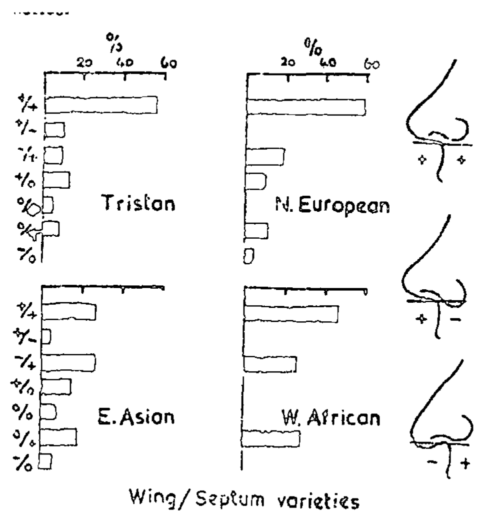
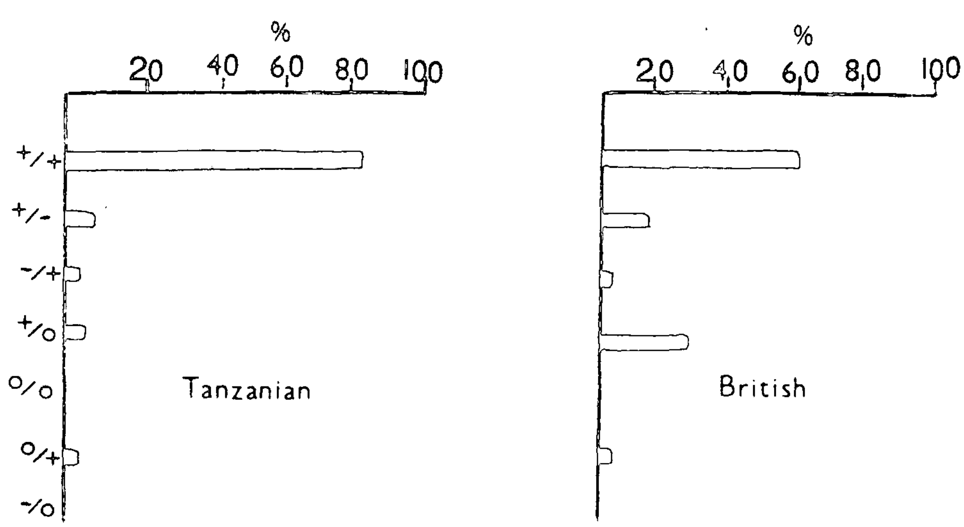
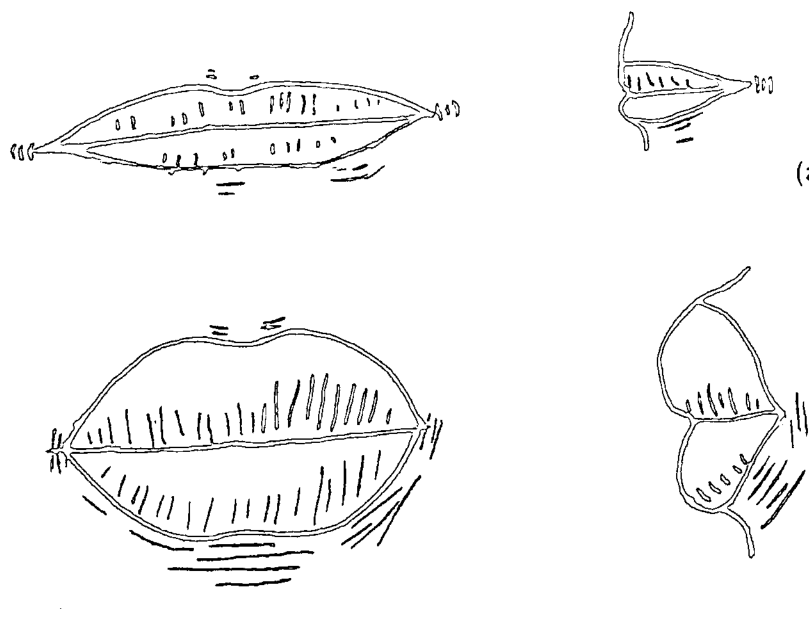


Figure 8.2(b) from this study



The Labial Vertical Relationship showed significant differences, Protrac--tion being much greater in the Tanzanians.

Figure 8.3 Lip Types (from Martin, 1920)



(a) European

(b) African Negro

The Tanzanians also seems to have a more protruding jaw than the British with their chins protruding more as found from the Chin Angle. The jaw also appears to be larger relative to the Vertical Height. This agrees with Poch (1916) who classified the Africans as prognathic and the Europeans as meso- or ortho-gnathic.

From the discriminant function analysis good separation was achieved between the British and Tanzanian samples (see Figure 6.3(a)). The males and females also separated out within each sample but the differences between them were not as great as between the two countries. The first Discriminant Function which accounted for over 90% of the vari--ance contained the Nasal Prominence Index, Chin Angle, Upper Lip Angle, Eye Fissure Index and Labial Protraction or Retraction. These are the variables which are related to the differences just described. It was possible, using the data obtained, to discriminate between the five tribes studied from Tanzania. The Nyakyusa and Sukuma have the largest faces in absolute terms and the Tutsi and Hehe the smallest. The Sukuma have the largest foreheads in absolute terms. There was no significant difference in slope of foreheads between the tribes. The various fea--tures of the face, (nose, mouth, eyes etc.) are again largest in the Nyakyusa and Sukuma and smallest in the Tutsi and Hehe, in absolute terms. There were no significant differences shown in any of the indices concern--ed with the position of the eyes in relation to head with (i.e. Occular Index, Interoccular Width Index and Bioccular Width Index). The Eye Fissure Index, however, did show up significant differences. The Hehe appear to have the largest eyes in relation to the size of the face follow--ed by Nyakyusa, Tutsi and Kinga whose eyes are approximately the same size in relation to face size. The Sukuma have the smallest eyes.

For the ears the Nyakyusa have the largest Ear Protrusion In--dex as well as the largest Biaural Breadth. The Nyakyusa's ears, there--fore, protrude to the greatest extent from the face followed in order by Kinga, Hehe, Sukuma and Tutsi. The Nyakyusa, again, have the largest noses in absolute terms. The Hehe have the largest Nasal Angle, however, and this approach closer to the Europeans. The Tutsi have the smallest Nasal Angle. There are significant differences in the Nasal Wing/Septum Relationship due to variation in the percentage of +/+ variety. Due to the high proportion of Hehe in the sample this would explain why the +/+ percentage is greater than expected for Tanzania as a whole (see Figure 8.2).

The Hehe also have a more prominent nose than the other groups. For the lips and mouth the Nyakyusa have the largest mouth in absolute terms but the Hehe have the largest Mouth Index suggesting that they have the thickest lips in proportion to the rest of the face. There were no significant differences shown in the Chin Angle or Mandibular Vertical Relationship. The lateral proportions of the face show signifi--cant differences between the tribes. Hehe appear to have faces which are narrow at the top and wider at the bottom in relation to the other tribes. When the Discriminant Function Analysis was performed scatter--plots were produced which showed the Hehe to have the central tendancy closely associated with the Kinga. The Tutsi and Sukuma were somewhat removed from this central grouping and so were the Nyakyusa but in the opposite direction (see Figures 6.4 and 6.5). These results go well with the geographical distribution. The Hehe and Kinga along with the Nyakyusa come from the South of the country and inter-marriages do take place. The Nyakyusa are removed slightly because they tend to be larger in stature. The Tutsi and Sukuma come from the North of the country and are quite separate from the rest and do not intermix because they too are well separated as shows up in the scatterplots.

The North East of Great Britain compared with the Rest of Great Britain could be discriminated using the variables. This is not surprising since the North East is a compact unit whereas the Rest is very diverse. Differences between the North East and the Rest were in the Upper Facial Height and depth of face which were larger in the Rest than in the North East. The Height of the Mouth was also a good discriminat--ing factor when the Discriminant Function Analysis was performed good separation was obtained between the North East sample and the Rest of Great Britain (see Figure 6.6), but the separation was not as good as was obtained between the sexes. Variables in Function 1 which accounted for over 50% of the variance were Auricle - Chin Distance, Biaural Breadth and Chin Angle. The males and females could easily be discriminated not only because of size but also because of various indices and angles. The most useful discriminators between male and female regardless of country were the Eye Fissure Index, Upper Lip Angle, Lower Face-Forehead Height Index, Labial Protraction/Retraction, Inter-occular Distance, Columella Length Index and Mandibular Protraction/Retraction. It appears that the females have proportionally larger eyes, less prominent noses, the chin does not protrude as much and neither do the lips.

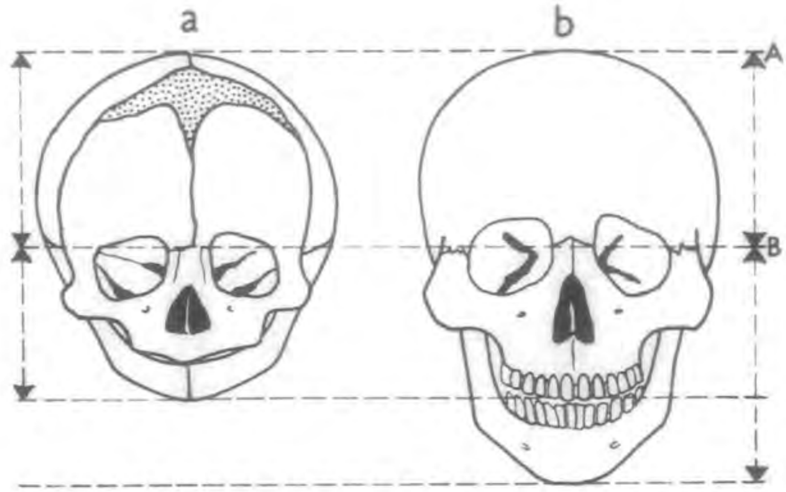
The adults when compared with the juveniles showed many differences which could be used to discriminate between the two groups. The obvious differences were shown in the dimensions which contribute to facial size but other characteristics were shown which were concerned with proportions, angles and relationships rather than absolute size. The forehead of the child does not slope as much as that of the adults. The ears seemed to protrude more in the adult. The lower face in pro--portion to the face as a whole was smaller in the juveniles than the adults. The Upper Facial Height was larger in proportion to the Lower Facial Height in the juveniles. In the adult the Lower Facial Height was greater than that of the upper face.

The chin protrudes less in the juveniles than in the adults. The Chin Angle was thus greater in the adults than in the children. The Nasal Height in proportion to the Lower Facial Height was larger in the children and smaller in the adults.

These differences are supported by work done on the growth of the skull (Sinclair, 1978). If you look at Figure 8.4 and 8.5 the growth of the face and skull are shown. The proportions of the various portions of the face increase as found in this study.

The final part of the study was very interesting the perform but the results were inconclusive. It appears that models of today do not approach the classical standards of beauty any more than the average British person. Standards of beauty have changed, however, and perhaps beauty cannot be measured in a quantitative way but is a purely subjec--tive aesthetic value. Farkas (1981) tested Canadian subjects and found that the Golden Rules of Proportion did not hold true. The level of Labial Fissure was found by him to be too low in almost all of the sub--jects tested (97 out of 101 females and in all 102 males).

Figure 8.4 Growth of Face

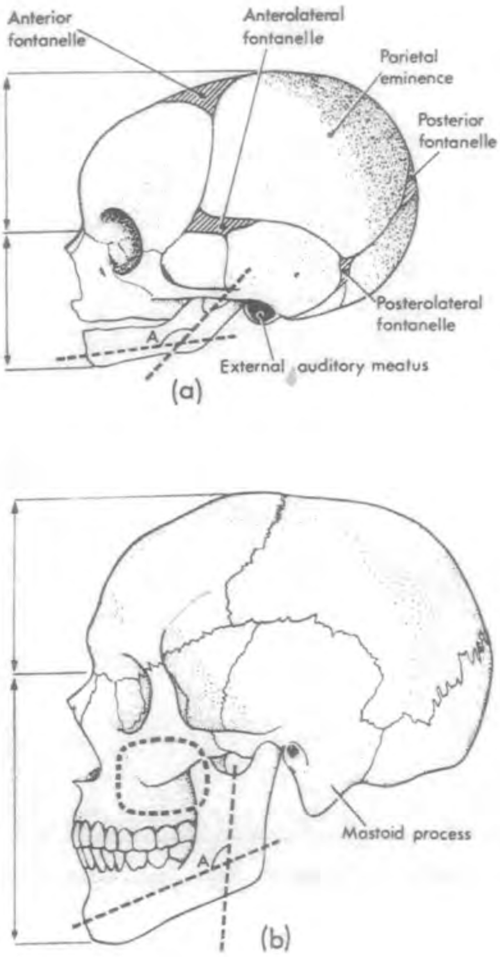


The childs skull (a) and the adult skull (b) have been drawn so that the distances between planes A and B are the same (from Sinclair, 1978).

It would have been interesting to apply some of the anthro--scopic tests to the faces collected and also look for assymetry which according to Farkas (1981) plays a large part in the individualisation of the face. If time had permitted I would have liked to have compared the measurements obtained by photogrammetry with the same measurements taken using anthropometric methods. I would like to have studied family resemblences, growth developments in the face, how we recognise people and if this is universal, faces of other parts of the world, faces link--ed to gene pools, whether people of various cultural and ethnic origins choose the same type of face as being beautiful etc., etc. Could the facial characteristics of particular races or ethnic groups act as a device for keeping gene pools constant. Mate selection from within

one's own group due to fact that these facial characteristics are pre-
-ferred. A good test would be to ask subjects to make preferences from various faces irrespective of colour of face etc., as suggested by Brothwell, Healy and Harvey (1965).

Figure 8.5 Growth of Skull



(a) skull of child
(b) skull of adult
Note relatively small size of face in (a). More upright mandible in (b) which is more prominent.
(From Sinclair, 1978)

I would have also liked, if time and finance had permitted, to use some of the new sophisticated techniques of stereophotogrammetry and optical contouring linked with image intensification and computer analysis and reproduction of contour maps, and how these may be of practical use in medicine for example. All of these would have been very stimulating and I am sure fruitful. Perhaps I may undertake some of them in the future.

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APPENDIX 1 - COMPUTER DATA ANALYSIS INFORMATION

Table A1.1 - Absolute Measurements

VIEW/PLANE	NO	MEASUREMENT	LANDMARKS	COMPUTER CODE
FRONTAL: Horizontal	1	Bizygomatic Diameter	zy - zy	BIZDI
	2	Biaural Breadth	ea - ea	BIAUBR
	3	Nasal Breadth	al - al	NASBR
	4	Inter-Occular Distance	on - on	IOCCD
	5	Bioccular Diameter	ex - ex	BIOCCDI
	6	Mouth Width	ch - ch	MTHW
FRONTAL: Vertical	7	Upper Lip Height	ls - sto	ULPH
	8	Lower Lip Height	sto - li	LLPH
	9	Total Lip Height	ls - li	TLPH
FRONTAL: Other	10	Right Eye Fissure Height	ps - pi	REFH
	11	Left Eye Fissure Height	ps - pi	LEFH
	12	Right Eye Fissure Width	en - ex	REFW
	13	Left Eye Fissure Width	en - ex	LEFW
PROFILE: Horizontal	14	Nasal Prominence	prn - ap	NASPR
	15	Nasal Bridge Distance	pi - x	NBRIDD
PROFILE: Vertical	16	Nasal Height	n - sn	NASH
	17	Height of Whole Upper Lip	sn - sto	PFSNSTD
	18	Vertical Height of Lower Face	sn - gn	SNGND
	19	Height of Forehead Above Eyebrows	tr - sci	PFTRSID
	20	Height of Upper Face	sci - sn	PFSISND
PROFILE: Lateral	21	Orbit-Auricle Distance	ex - po	ORAUD
	22	Auricle - Chin Distance	po - pg	AUCHD
	23	Height of Face	n - gn	LWFACH
	24	Columella Length	c - sn	COLL
PROFILE: Angle	25	Nasal Angle		NASAN
	26	Nasal Base Angle		NBAN
	27	Upper Lip Angle		ULPAN
	28	Chin Angle		CHNAN
	29	Frontal Recession Angle		FRECAN
PROFILE: Relation--ships	30	Nasal Wing/Septum Relationship		NWSREL
	31	Frontal Protraction/Retraction		FPOR
	32	Nasal Protraction /Retraction		NPOR
	33	Labial Protraction/Retraction		LPOR
	34	Mandibular Protraction/Retraction		MPOR

Table A1.2 - Indices

VIEWS	NO.	INDEX	CODE
FRONT VIEW ONLY	1	Ear Protrusion Index	EPIX
	2	Mouth Index	MIX
	3	Lip Index	LPIX
	4	Eye Fissure Index	EFIX
	5	Occular Index	OCCIX
	6	Mouth Width Index	MWHIX
	7	Nasal Breadth Index	NBHIX
	8	Inter-Occular Width Index	IOCCHIX
	9	Biocculer Width Index	BIOCCHIX
	10	Mouth - Nose Width Index	GPEI
	11	Biocculer - Mouth Width Index	GPEH
	12	Interoccular - Nasal Width Index	IENWIX
PROFILE VIEW ONLY	13	Upper Face-Forehead Height Index	SFTPIX
	14	Upper - Lower Facial Height Index	STTPIX
	15	Lower Face - Forehead Height Index	TFTPIX
	16	Lower Face Proportion Index	MLPIX
	17	Nasal Height - Prominence Index	NHPRMIX
	18	Nasal Prominence - Bridge Index	NSIX
	19	Whole Upper Lip Vertical Index	ULVIX
	20	Lower Facial Height Vertical Index	NCVIX
	21	Nasal Columella Length Index	CLVIX
	22	Lateral Proportion Index I	LPIXA
	23	Lateral Proportion Index II	LPIXB
	24	Lateral Proportion Index III	LPIXC
	25	Nasal Prominence Lateral Index	NPRMLIX
	26	Nasal Bridge Distance Lateral Index	NBRDLIX
PROFILE AND FRONT VIEWS	27	General Facial Size Factor Index	GFSF
	28	Nasal Bridge Index	NASBRIX
	29	Nasal Prominence Index	NWSIX
	30	Nasal Index	NASIX

TABLE A1.3 - Computer Data Entry Sheet

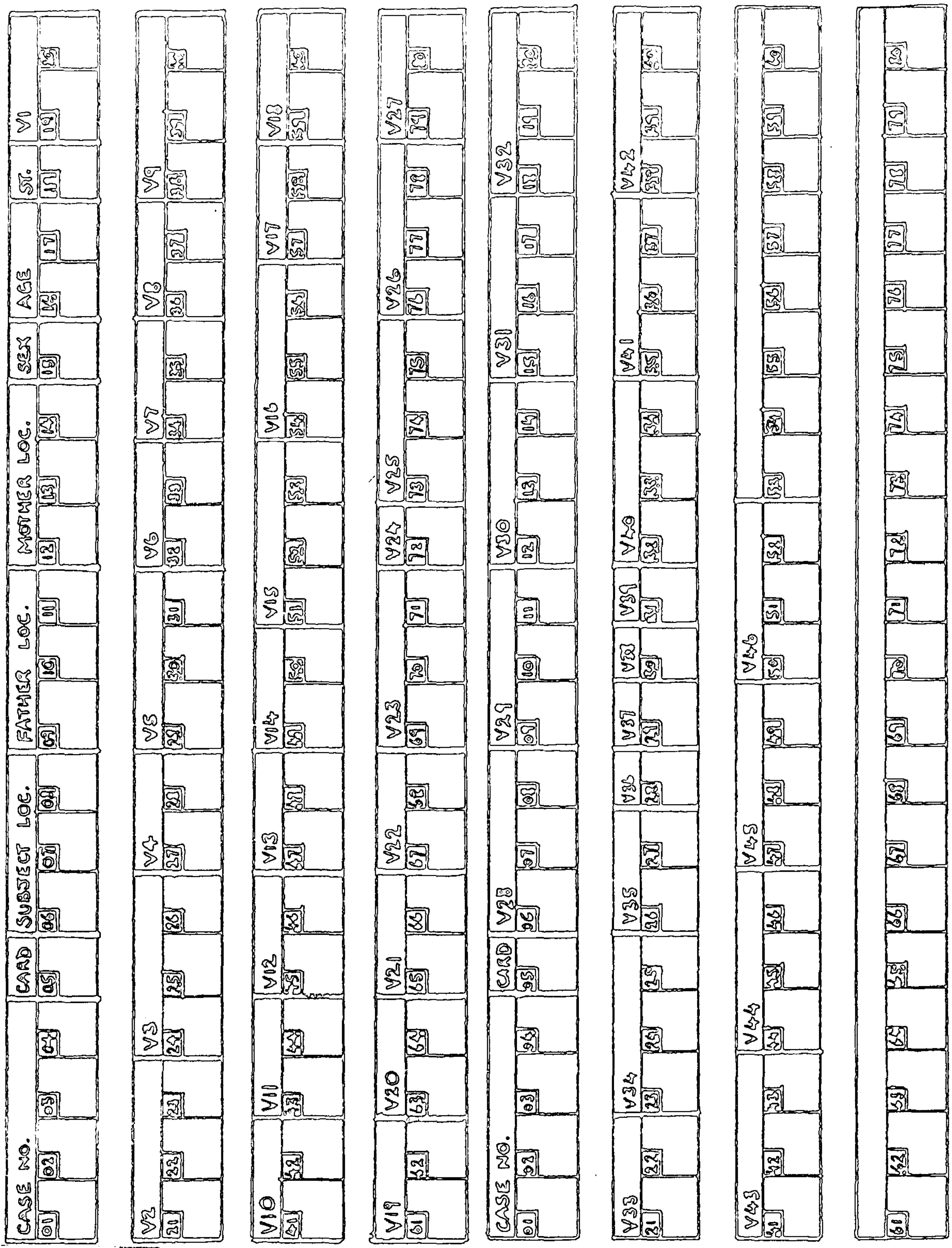

Table A1.4 - Computer Data Sheet Codes

VARIABLE NUMBER	VARIABLE LABEL	CODES	CARD COLUMNS
			Card One
	CSENO	0001 - 0800	01 - 04
	CRDNO	1 or 2	05
	SLOC	101 - 404	06 - 08
	FLOC	101 - 404 999=Missing Data	09 - 11
	MLOC	101 - 404 999=Missing Data	12 - 14
	SX	1 = MALE 2 = FEMALE	15
	AG	Numerical Value in Years 99=Missing Data	16 - 17
	STAT	1 = ADULT 2 = JUVENILE	18
V1	NASBR	Numerical Value in mm. 99=Missing Data	19 - 20
V2	BIZDI	Numerical Value in mm. 999=Missing Data	21 - 23
V3	BIAUBR	Numerical Value in mm. 999=Missing Data	24 - 26
V4	IOCCD	Numerical Value in mm. 99=Missing Data	27 - 28
V5	BIOCCDI	Numerical Value in mm. 999=Missing Data	29 - 31
V6	MTHW	Numerical Value in mm. 99=Missing Data	32 - 33
V7	ULPH	Numerical Value in mm. 99=Missing Data	34 - 35
V8	LLPH	Numerical Value in mm. 99=Missing Data	36 - 37
V9	ORAUD	Numerical Value in mm. 999=Missing Data	38 - 40
V10	TLPH	Numerical Value in mm. 99=Missing Data	41 - 42
V11	REFW	Numerical Value in mm. 99=Missing Data	43 - 44
V12	LEFW	Numerical Value in mm. 99=Missing Data	45 - 46
V13	REFH	Numerical Value in mm. 99=Missing Data	47 - 48
V14	LEFH	Numerical Value in mm. 99=Missing Data	49 - 50
V15	LWFACH	Numerical Value in mm. 999=Missing Data	51 - 53
V16	AUCHD	Numerical Value in mm. 999=Missing Data	54 - 56
V17	NASPR	Numerical Value in mm. 99=Missing Data	57 - 58
V18	NBRIDD	Numerical Value in mm. 99=Missing Data	59 - 60
V19	NASH	Numerical Value in mm. 99=Missing Data	61 - 62
V20	PFSNSTD	Numerical Value in mm. 99=Missing Data	63 - 64
V21	COLL	Numerical Value in mm. 99=Missing Data	65 - 66
V22	NASAN	Numerical Value in degree 99=Missing Data	67 - 68
V23	NBAN	Numerical Value in degrees + or - of vertical 0 = Vertical 999=Missing Data	69 - 71
V24	NWSREL	0 = 0/0, 1 = +/+, 2 = +/-, 3 = -/+, 4 = -/- 5 = +/0, 6 = 0/+, 7 = 0/-, 8 = -/0, 9 = Missing Data	72
V25	ULPAN	Numerical Value in degrees + or - of vertical, 0 = Vertical 999=Missing Data	73 - 75
V26	CHNAN	Numerical Value in degrees + or - of vertical, 0 = Vertical 999=Missing Data	76 - 78
V27	FRECAN	Numerical Value in degree 99=Missing Data	79 - 80
			Card Two
V28	VGND	Numerical Value in mm. 999=Missing Data	06 - 08
V29	VEXD	Numerical Value in mm. 999=Missing Data	09 - 11
V30	TREXD	Numerical Value in mm. 999=Missing Data	12 - 14
V31	EXGND	Numerical Value in mm. 999=Missing Data	15 - 17
V32	EXSTD	Numerical Value in mm. 999=Missing Data	18 - 20
V33	EXPRD	Numerical Value in mm. 99=Missing Data	21 - 22
V34	PRGND	Numerical Value in mm. 999=Missing Data	23 - 25
V35	STGND	Numerical Value in mm. 99=Missing Data	26 - 27

Table A1.4(continued)

VARIABLE NUMBER	VARIABLE LABEL	CODES	CARD COLUMNS
V36	FPOR	Relationship to Vertical 1 = Protraction, 2 = Retraction, 3 = Vertical, 9=Missing Data	28
V37	NFOR	Relationship to Vertical 1 = Protraction, 2 = Retraction, 3 = Vertical, 9=Missing Data	29
V38	LPOR	Relationship to Vertical 1 = Protraction, 2 = Retraction, 3 = Vertical, 9=Missing Data	30
V39	MPOR	Relationship to Vertical 1 = Protraction, 2 = Retraction, 3 = Vertical, 9=Missing Data	31
V40	FTRSID	Numerical Value in mm. 999=Missing Data	32 - 34
V41	FSISND	Numerical Value in mm. 999=Missing Data	35 - 37
V42	FSNSTD	Numerical Value in mm. 999=Missing Data	38 - 40
V43	PFTRSID	Numerical Value in mm. 999=Missing Data	41 - 43
V44	PFSISND	Numerical Value in mm. 999=Missing Data	44 - 46
V45	SNGND	Numerical Value in mm. 999=Missing Data	47 - 49
V46	SNLID	Numerical Value in mm. 999=Missing Data	50 - 52

Table A1.5 - Variable List

FILE NAMES: FACES, FACES2, FACES3, FACES4.

VARIABLE LIST: CSENO, CRDNO, SLOC, FLOC, MLOC, SX, AG, STAT, NASBR, BIZDI, BIAUBR, IOCCD, BIOCCDI, MTHW, ULPH, LLPH, ORAUD, TLPH, REFW, LEFW, REFH, LEFH, LWFACH, AUCHD, NASPR, NBRIDD, NASH, PFSNSTD, COLL, NASAN, NBAN, NWSREL, ULPAN, CHNAN, FRECAN, VGND, VEXD, TREXD, EXGND, EXSTD, EXPRD, PRGND, STGND, FPOR, NPOR, LPOR, MPOR, FTRSID, FSISND, FSNSTD, PFTRSID, PFSISND, SNGND, SNLID.

VARIABLE LABELS:

CSENO	CASE NUMBER
CRDNO	CARD NUMBER
SLOC	SUBJECT LOCATOR
FLOC	FATHER LOCATOR
MLOC	MOTHER LOCATOR
SX	SEX OF SUBJECT
AG	AGE OF SUBJECT
STAT	STATUS OF SUBJECT

NASBR To SNLID (see Table 1.1)

MISSING VALUES

CODES FOR MISSING VALUE(S) =

9 for: NWSREL, FPOR, NPOR, LPOR, MPOR

99 for: AG, NASBR, IOCCD, MTHW, ULPH, LLPH, TLPH, REFW, LEFW, REFH, LEFH, NASPR, NBRIDD, NASH, PFSNSTD, COLL, NASAN, FRECAN, EXPRD, STGND.

999 for: FLOC, MLOC, BIZDI, BIAUBR, BIOCCDI, ORAUD, LWFACH, AUCHD, NBAN, ULPAN, CHNAN, VGND, VEXD, TREXD, EXGND, EXSTD, PRGND, FTRSID, FSISND, FSNSTD, PFTRSID, PFSISND, SNGND, SNLID.

Table A1.6 - Subject Locator Codes

ENGLAND

101	Cornwall	116	Suffolk	131	Nottinghamshire
102	Devon	117	Norfolk	132	Derbyshire
103	Somerset	118	Cambridgeshire	133	Cheshire
104	Dorset	119	Hertfordshire	134	Merseyside
105	Avon	120	Bedfordshire	135	Greater Manchester
106	Gloucestershire	121	Buckinghamshire	136	Lancashire
107	Wiltshire	122	Oxfordshire	137	West Yorks.
108	Berkshire	123	Northamptonshire	138	South Yorks.
109	Hampshire	124	Warwickshire	139	Humberside
110	West Sussex	125	Hereford and Worcester	140	North Yorks.
111	East Sussex	126	Salop	141	Cumbria
112	Surrey	127	Staffordshire	142	Co. Durham
113	Kent	128	West Midlands	143	Cleveland
114	Greater London	129	Leicestershire	144	Tyne and Wear
115	Essex	130	Lincolnshire	145	Northumberland

WALES

146	Clwyd
147	Gwynedd
148	Dyfed
149	Powys
150	West Glamorgan
151	Mid. Glamorgan
152	South Glamorgan
153	Gwent

SCOTLAND

154	Dumfries and Galloway	160	Tayside
155	Borders	161	Grampian
156	Lothian	162	Highland
157	Strathclyde	163	Western Isles
158	Central	164	Orkney
159	Fife	165	Shetland

NORTHERN IRELAND

166	Antrim	170	Fermanagh
167	Belfast	171	Londonderry
168	Armagh	172	Tyrone
169	Down		

EIRE

173	Carlow	181	Offaly	190	Waterford
174	Dublin	182	Westmeath	191	Galway
175	Kildare	183	Wexford	192	Leitrim
176	Kilkenny	184	Wicklow	193	Mayo
177	Laoighis	185	Clare	194	Roscommon
178	Longford	186	Cork	195	Sligo
179	Louth	187	Kerry	196	Cavan
180	Meath	188	Limerick	197	Donegal
		189	Tipperary	198	Monaghan

Table A1.6 (continued)

OTHER PARTS OF BRITAIN

199	Isle of Man	217	Northern Scotland
200	Isle of Wight	218	Southern Scotland
201	Channel Islands	219	Eastern Scotland
202	Scilly Isles	220	Western Scotland
203	England Unspecified	221	Ireland
204	Northern England	222	Northern Ireland
205	North-East England	223	Eire (Rep. of Ireland)
206	North-West England	224	Northern Eire
207	Midlands of England	225	Southern Eire
208	East Anglia	226	Other parts of British Isles
209	West of England	227	Other Countries of British Parents
210	Southern England	228	Other Countries of English Parents
211	South-East England	229	Other Countries of Scottish Parents
212	South-West England	230	Other Countries of Welsh Parents
213	Wales	231	Other Countries of Irish Parents
214	North Wales		
215	South Wales		
216	Scotland		

OTHER COUNTRIES

232	U.S.A.
233	Canada
234	New Zealand
235	Australia
236	France
237	Belgium
238	Netherlands
239	W. Germany
240	E. Germany
241	Switzerland
242	Italy
243	Spain
244	Portugal
245	Greece
246	W. Indies
247	S. Africa
248	Nigeria
249	India
250	Pakistan
251	China
252	Japan
253	Mexico
254	U.S.S.R.
255	Hong Kong
256	Cyprus
257	Denmark
258	Norway
259	Sweden

TRIBES OF TANZANIA

Absolute Measurements - Scaled Photographs

301 Hehe
302 Tutsi
303 Sukuma
304 Nyakyusa
305 Kinga

Direct Measurements - Unscaled Photographs

307 Hehe
308 Tutsi
309 Sukuma
310 Nyakyusa
311 Kinga

Unscaled Photographs (For combination - each view scaled independently)

313 Hehe
314 Tutsi
315 Sukuma
316 Nyakyusa
317 Kinga

Fulleborn Photographs - Unscaled

319 Hehe
320 Tutsi
321 Sukuma
322 Nyakyusa
323 Kinga

Magazine Models

401 Female - Front View - unscaled - direct measurements

402 Female - Profile View - unscaled - direct measurements

403 Male - Front View - unscaled - direct measurements

404 Male - Profile View - unscaled - direct measurements

Table A1.7 - Populations used in Study

Pop.	Title	Made From	Cases	MA	FA	MJ	FJ
4	Rest of Gt. Britain	SLOCS: 101-141/146-204/206-259	115	64	51		
7	Hehe Dir. no Full.	SLOCS: 307 + 313	57	35	17	3	2
8	Hehe Abs.	SLOC: 301	169	66	46	28	29
10	Tutsi Abs.	SLOC: 302	38	11	15	8	4
12	Sukuma Abs.	SLOC: 303	49	49			
14	Nyakyusa Abs.	SLOC: 304	65	65			
15	Kinga Dir. no Full.	SLOCS: 311 + 317	19	16	3		
16	Kinga Abs.	SLOC: 305	3	1		2	
17	Mag.Models Dir.	SLOCS: 401 to 404	193	44	149		
18		SLOCS: 319 to 323					
19	N.East of G.Britain	SLOCS: 142 to 145 + 205	54	35	19		
20	Hehe Full. Dir.	SLOC: 319	11	11			
21	Nyakyusa Full. Dir.	SLOC: 322	17	13	4		
22	Kinga Full. Dir.	SLOC: 323	3	2	1		
23	Full. All Tribes Dir.	POPS: 20; 21; 22	31	26	5		
24	Kinga Dir.	POPS: 15; 22	22	18	4		
25	Kinga Abs. + Dir.	POPS: 15; 24	25	19	4	2	
26	Nyakyusa Abs. + Dir.	POPS: 14; 21	82	78	4		
27	Hehe Dir.	POPS: 7; 20	68	46	17	3	2
28	Hehe Abs. + Dir.	POPS: 8; 27	237	112	63	31	31
29	Tanzania Abs.	POPS: 8; 10; 12; 14; 16	324	192	63	36	33
30	Tanz. Abs. + Dir.	POPS: 25; 26; 10; 12; 28	431	269	86	41	35
31	Tanz.Abs.+Dir.no Full	POPS: 7; 15; 29	400	243	83	39	35
32	G.Britain All Abs.	POPS: 19; 4	169	99	70		
33	All Cases TZ;GB:Abs.	POPS: 29; 32	493	291	133	36	33
34	All Cases Dir.+ Abs. no MM.	POPS: 30; 32	607	374	156	41	35
35	All Cases Dir.	POPS: 17; 34	800	396	327	41	35

APPENDIX 2 - DESCRIPTIVE STATISTICS

Appendix 2(a) - Descriptive Statistics using Front View only for Measurements

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	153.806	0.760	12.923	+0.380	+0.364	121	203
ALL	FA	130	141.731	0.960	10.944	+0.441	+0.694	119	175
GB	MA	99	146.636	0.856	8.512	+0.098	-0.243	125	167
GB	FA	70	138.829	1.024	8.570	+1.011	+0.357	119	168
TANZ.	MA	190	157.542	0.962	13.265	+0.306	+0.105	121	203
TANZ.	FA	60	145.117	1.604	12.423	-0.503	+0.471	126	175
TANZ.	MJ	38	140.132	1.701	10.486	-0.514	+0.045	119	162
TANZ.	FJ	32	139.500	1.540	8.710	+0.355	-0.648	117	155
HEHE	MA	66	149.894	1.094	8.889	+3.422	+1.268	134	186
HEHE	FA	45	149.222	1.718	11.522	-0.264	+0.201	126	175
HEHE	MJ	28	144.321	1.574	8.327	-0.517	+0.266	131	162
HEHE	FJ	28	141.750	1.223	6.473	-0.139	-0.078	129	155
TUTSI	MA	10	135.500	2.721	8.606	-0.810	-0.010	121	148
TUTSI	FA	15	132.800	1.047	4.057	-0.007	+0.130	126	141
SUKUMA	MA	49	159.388	1.299	9.092	-0.562	-0.214	140	178
NYAK.	MA	64	168.062	1.245	9.962	+1.880	+0.728	142	203

Table A21 - Bizygomatic Diameter (mm)

Table A2.2 - Biaural Breadth (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	183.291	0.812	13.806	+0.066	-0.008	148	229
ALL	FA	128	168.578	0.960	10.858	+0.095	+0.476	142	201
GB	MA	99	182.040	1.363	13.565	-0.131	-0.288	148	213
GB	FA	69	168.203	1.254	10.417	+0.015	+0.192	142	195
TANZ.	MA	190	183.942	1.010	13.921	+0.113	+0.117	152	229
TANZ.	FA	59	169.017	1.488	11.427	+0.117	+0.720	151	201
TANZ.	MJ	38	168.263	1.579	9.736	+0.978	+0.346	147	196
TANZ.	FJ	32	168.687	2.043	11.558	-0.711	+0.011	147	190
HEHE	MA	66	176.000	1.354	11.003	+1.363	+0.641	153	216
HEHE	FA	44	171.909	1.734	11.503	-0.240	+0.496	153	201
HEHE	MJ	28	171.464	1.632	8.654	+1.338	+0.678	156	196
HEHE	FJ	28	170.607	1.953	10.333	-0.826	+0.221	153	190
TUTSI	MA	10	161.202	2.279	7.208	-1.636	-0.157	152	172
TUTSI	FA	15	160.533	1.440	5.579	-0.893	-0.465	151	169
SUKUMA	MA	49	188.551	1.582	11.074	+2.575	+0.739	166	229
NYAK.	MA	64	192.437	1.326	10.607	+0.005	+0.405	173	222

Table A2.3 - Nasal Breadth (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	49.827	0.496	8.427	-1.055	+0.012	33	67
ALL	FA	130	42.677	0.613	6.993	-0.434	+0.615	31	60
GB	MA	99	40.646	0.332	3.302	-0.478	-0.144	33	48
GB	FA	70	37.914	0.406	3.395	-0.659	+0.247	31	45
TANZ.	MA	190	54.611	0.432	5.950	-0.165	-0.211	39	67
TANZ.	FA	60	48.233	0.765	5.927	-0.439	+0.014	34	60
TANZ.	MJ	38	45.974	1.005	6.197	-0.703	+0.171	36	60
TANZ.	FJ	32	45.687	0.701	3.963	+0.259	+0.337	39	56
HEHE	MA	66	52.409	0.574	4.664	+0.670	+0.496	43	66
HEHE	FA	45	50.422	0.711	4.770	-1.114	+0.359	43	60
HEHE	MJ	28	47.857	1.091	5.772	-0.419	-0.070	37	60
HEHE	FJ	28	46.571	0.641	3.392	+0.947	+0.747	40	56
TUTSI	MA	10	42.600	0.833	2.663	+0.720	+0.772	39	48
TUTSI	FA	15	41.667	0.998	3.867	-0.265	-0.204	34	48
SUKUMA	MA	49	54.898	0.563	3.944	-0.288	+0.039	47	63
NYAK.	MA	64	58.766	0.586	4.686	-0.720	-0.228	49	67

Table A2.4 - Interoccular Distance (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	38.630	0.358	6.093	+0.056	+0.184	20	60
ALL	FA	130	35.385	0.510	5.818	-0.244	+0.396	23	52
GB	MA	99	33.535	0.433	4.313	+1.115	+0.109	20	46
GB	FA	70	32.014	0.514	4.299	+1.952	+0.798	23	48
TANZ.	MA	190	41.284	0.372	5.123	+0.269	+0.355	27	60
TANZ.	FA	60	39.317	0.622	4.817	-0.145	+0.225	31	52
TANZ.	MJ	38	38.184	0.573	3.533	+0.381	+0.492	31	47
TANZ.	FJ	32	37.687	0.767	4.336	-1.196	+0.057	31	45
HEHE	MA	66	39.924	0.475	3.860	-0.129	+0.576	34	50
HEHE	FA	45	40.644	0.661	4.432	+0.382	+0.179	31	52
HEHE	MJ	28	39.071	0.652	3.453	+0.088	+0.505	34	47
HEHE	FJ	28	38.429	0.772	4.086	-1.033	-0.112	31	45
TUTSI	MA	10	35.600	1.579	4.993	+2.048	+0.370	27	46
TUTSI	FA	15	35.333	0.944	3.658	-0.433	+0.702	31	42
SUKUMA	MA	49	41.857	0.727	5.087	-0.274	+0.387	32	52
NYAK.	MA	64	43.281	0.654	5.230	+0.586	+0.204	32	60

Table A2.5 - Bioccular Diameter (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	108.761	0.656	11.151	+0.450	+0.264	85	141
ALL	FA	130	99.962	0.807	9.202	+0.644	+0.779	83	132
GB	MA	99	98.909	0.633	6.299	+1.186	+0.531	85	120
GB	FA	70	95.100	0.651	5.443	-0.060	+0.100	83	107
TANZ.	MA	190	113.895	0.694	9.570	+0.133	+0.056	87	141
TANZ.	FA	60	105.633	1.223	9.472	+0.166	+0.264	87	132
TANZ.	MJ	38	103.184	1.204	7.421	+0.445	+0.503	92	125
TANZ.	FJ	32	102.906	1.646	9.313	+0.675	+0.561	87	129
HEHE	MA	66	108.803	0.809	6.576	+1.495	-0.125	87	128
HEHE	FA	45	108.667	1.280	8.586	+1.369	+0.084	87	132
HEHE	MJ	28	105.857	1.236	6.542	+1.459	+0.583	93	125
HEHE	FJ	28	104.786	1.573	8.324	+1.329	+0.867	91	129
TUTSI	MA	10	97.800	1.638	5.181	-0.082	+0.197	90	107
TUTSI	FA	15	96.533	1.369	5.303	+0.273	+1.028	91	108
SUKUMA	MA	49	114.163	0.831	5.814	-0.111	+0.462	99	124
NYAK.	MA	64	121.781	0.985	7.879	-0.349	+0.143	105	141

Table A2.6 - Mouth Width (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	273	68.619	0.642	10.603	-0.799	-0.078	42	93
ALL	FA	113	58.469	0.735	7.811	+0.096	+0.442	41	84
GB	MA	99	58.091	0.621	6.179	+0.050	+0.278	42	73
GB	FA	69	54.406	0.691	5.740	+2.426	+0.721	41	75
TANZ.	MA	174	74.609	0.565	7.457	+0.075	-0.114	54	93
TANZ.	FA	44	64.481	0.939	6.228	+0.953	+0.285	52	84
TANZ.	MJ	31	62.581	1.132	6.302	+0.187	-0.166	47	76
TANZ.	FJ	29	61.931	0.875	4.713	-0.430	-0.281	51	70
HEHE	MA	60	70.400	0.894	6.921	-0.642	-0.244	54	84
HEHE	FA	38	65.658	0.976	6.019	+1.600	+0.251	52	84
HEHE	MJ	26	54.269	0.998	5.088	-0.455	+0.403	56	76
HEHE	FJ	28	62.179	0.870	4.603	-0.183	-0.352	51	70
TUTSI	MA	6	59.667	2.171	5.317	+1.156	+1.249	55	69
TUTSI	FA								
SUKUMA	MA	48	75.417	0.963	6.671	+0.749	-0.273	58	91
NYAK.	MA	63	78.413	0.795	6.308	-0.258	+0.377	66	93

Table A2.7 - Upper Lip Height (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	277	13.029	0.299	4.982	-0.226	-0.308	3	24
ALL	FA	113	10.097	0.393	4.175	-0.398	+0.073	3	22
GB	MA	96	7.187	0.210	2.059	+0.569	-0.299	3	17
GB	FA	59	6.712	0.237	1.820	+0.404	-0.396	3	14
TANZ.	MA	181	16.127	0.210	2.825	-0.373	+0.150	10	24
TANZ.	FA	54	13.796	0.347	2.550	+0.402	-0.007	9	22
TANZ.	MJ	33	13.273	0.349	2.004	-0.385	-0.563	9	18
TANZ.	FJ	31	13.613	0.461	2.565	+0.551	+0.659	11	21
HEHE	MA	63	14.762	0.291	2.312	+1.055	+0.702	10	24
HEHE	FA	43	14.023	0.368	2.415	+0.109	-0.326	9	20
HEHE	MJ	27	13.407	0.386	2.005	-0.084	-0.794	9	18
HEHE	FJ	28	13.786	0.475	2.515	+0.306	+0.542	11	21
TUTSI	MA	7	15.857	1.122	2.968	+0.052	-0.582	13	18
TUTSI	FA	11	12.909	0.899	2.982	+2.531	+1.055	11	22
SUKUMA	MA	48	16.646	0.428	2.964	+1.351	+0.525	10	26
NYAK.	MA	63	17.127	0.338	2.679	-0.779	-0.010	11	22

Table A2.8 - Lower Lip Height (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	277	14.751	0.247	4.107	-0.226	-0.308	3	24
ALL	FA	113	12.637	0.342	3.630	-0.398	+0.073	3	22
GB	MA	96	10.594	0.292	2.856	+0.569	-0.299	3	17
GB	FA	59	10.034	0.299	2.297	+0.404	-0.396	3	14
TANZ.	MA	181	16.956	0.203	2.730	-0.373	+0.150	10	24
TANZ.	FA	54	15.481	0.341	2.508	+0.402	-0.007	9	22
TANZ.	MJ	33	14.182	0.412	2.365	-0.385	-0.563	9	18
TANZ.	FJ	31	15.032	0.413	2.302	+0.551	+0.659	11	21
HEHE	MA	63	15.651	0.340	2.695	+1.055	+0.702	10	24
HEHE	FA	43	15.488	0.376	2.463	+0.109	-0.326	9	20
HEHE	MJ	27	14.370	0.475	2.467	-0.084	-0.794	9	18
HEHE	FJ	28	15.143	0.450	2.384	+0.306	+0.542	11	21
TUTSI	MA	7	15.857	0.634	1.676	+0.052	-0.582	13	18
TUTSI	FA	11	15.455	0.846	2.806	+2.531	+1.005	11	22
SUKUMA	MA	48	17.708	0.375	2.601	-0.615	+0.464	13	23
NYAK.	MA	63	17.810	0.307	2.435	-0.499	-0.499	12	22

Table A2.9 - Total Height of Lips (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	277	27.780	0.516	8.583	-0.948	-0.265	8	48
ALL	FA	113	22.743	0.699	7.426	-0.973	+0.182	8	41
GB	MA	96	17.729	0.405	3.972	+0.316	+0.264	8	29
GB	FA	59	16.729	0.461	3.542	+0.171	-0.144	8	25
TANZ.	MA	181	33.110	0.350	4.709	-0.217	+0.214	20	48
TANZ.	FA	54	29.315	0.586	4.304	+0.427	-0.037	18	41
TANZ.	MJ	33	27.455	0.598	3.438	-1.084	-0.314	22	33
TANZ.	FJ	31	28.452	0.743	4.138	+0.106	+0.546	22	39
HEHE	MA	63	30.349	0.526	4.178	+0.073	+0.403	20	40
HEHE	FA	43	29.558	0.603	3.954	-0.62	-0.275	20	36
HEHE	MJ	27	27.741	0.672	3.493	-1.029	-0.409	22	33
HEHE	FJ	28	28.714	0.797	4.215	-0.038	+0.464	22	39
TUTSI	MA	7	31.714	1.392	3.364	-0.423	-0.187	26	37
TUTSI	FA	11	28.364	1.686	5.591	+2.903	+0.666	18	41
SUKUMA	MA	48	34.479	0.668	4.626	+0.368	+0.716	27	48
NYAK.	MA	63	34.984	0.510	4.050	-0.727	-0.169	27	44

Table A2.10 - Right Eye Fissure Height (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	287	11.505	0.142	2.406	+0.353	+0.242	6	20
ALL	FA	127	10.228	0.180	2.032	+0.038	+0.341	6	16
GB	MA	98	10.010	0.202	2.003	-0.741	-0.085	6	14
GB	FA	67	9.418	0.212	1.733	-0.307	+0.097	6	14
TANZ.	MA	189	12.280	0.162	2.229	+0.555	+0.405	8	20
TANZ.	FA	60	11.133	0.254	1.970	-0.252	+0.400	7	16
TANZ.	MJ	38	10.263	0.279	1.719	+0.618	+0.174	7	15
TANZ.	FJ	31	11.452	0.314	1.748	-0.951	-0.074	8	15
HEHE	MA	65	10.585	0.196	1.580	-0.745	+0.158	8	14
HEHE	FA	45	11.156	0.324	2.174	-0.577	+0.375	7	16
HEHE	MJ	28	9.786	0.283	1.500	-0.149	-0.245	7	13
HEHE	FJ	27	11.556	0.343	1.783	-0.952	-0.142	8	15
TUTSI	MA	10	11.100	0.433	1.370	+1.505	+0.751	9	14
TUTSI	FA	15	11.067	0.316	1.223	-1.032	+0.127	9	13
SUKUMA	MA	49	13.102	0.321	2.248	+1.472	+0.694	8	20
NYAK.	MA	64	13.594	0.203	1.620	+1.412	+0.831	11	19

Table A2.11 - Left Eye Fissure Height (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	287	11.463	0.145	2.465	+0.231	+0.351	6	20
ALL	FA	127	10.244	0.195	2.192	+0.354	+0.271	5	17
GB	MA	98	9.908	0.194	1.922	-0.678	-0.098	6	14
GB	FA	67	9.269	0.224	1.831	-0.354	-0.152	5	14
TANZ.	MA	189	12.270	0.169	2.328	+0.153	+0.440	8	20
TANZ.	FA	60	11.333	0.265	2.056	+0.205	+0.465	7	17
TANZ.	MJ	38	10.816	0.299	1.843	-0.328	+0.614	8	15
TANZ.	FJ	31	11.194	0.291	1.521	-0.100	+0.468	8	15
HEHE	MA	65	10.446	0.178	1.436	-0.690	+0.144	8	13
HEHE	FA	45	11.333	0.318	2.132	-0.523	+0.131	7	16
HEHE	MJ	28	10.464	0.323	1.710	+0.288	+0.788	8	15
HEHE	FJ	27	11.148	0.310	1.610	+0.138	+0.457	8	15
TUTSI	MA	10	10.900	0.379	1.917	-0.369	+0.233	9	13
TUTSI	FA	15	11.333	0.485	1.877	+5.663	+2.207	10	17
SUKUMA	MA	49	13.327	0.344	2.410	+0.787	+0.548	9	20
NYAK.	MA	64	13.562	0.219	1.754	+0.096	+0.084	9	18

Table A2.12 - Right Eye Fissure Width (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	34.121	0.231	3.935	+1.187	+0.337	20	50
ALL	FA	130	32.054	0.266	3.038	+0.953	+0.002	22	42
GB	MA	99	32.535	0.307	3.055	+2.876	-0.599	20	40
GB	FA	70	31.471	0.280	2.339	+0.561	-0.523	25	37
TANZ.	MA	190	34.947	0.297	4.092	+0.556	+0.335	23	50
TANZ.	FA	60	32.733	0.464	3.593	+0.497	-0.168	22	42
TANZ.	MJ	38	31.711	0.418	2.578	+0.563	+0.049	26	38
TANZ.	FJ	32	31.875	0.605	3.424	-0.369	+0.067	25	39
HEHE	MA	66	33.015	0.395	3.208	+0.826	-0.654	23	40
HEHE	FA	45	33.222	0.555	3.723	+0.959	-0.432	22	42
HEHE	MJ	28	32.286	0.460	2.432	+0.766	+0.223	27	38
HEHE	FJ	28	32.214	0.659	3.489	-0.256	-0.142	25	39
TUTSI	MA	10	31.700	0.517	1.636	-1.093	-0.350	29	34
TUTSI	FA	15	31.267	0.720	2.789	-0.359	+0.458	27	37
SUKUMA	MA	49	34.714	0.608	4.257	+2.252	+1.152	28	50
NYAK.	MA	64	37.641	0.441	3.525	-0.201	-0.170	30	46

Table A2.13 - Left Eye Fissure Width (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	34.574	0.229	3.889	+2.264	+0.871	25	53
ALL	FA	130	32.162	0.248	2.828	+2.340	+0.161	22	42
GB	MA	99	33.141	0.265	2.638	+0.099	+0.170	26	40
GB	FA	70	31.971	0.242	2.021	+1.902	+0.365	26	39
TANZ.	MA	190	35.321	0.306	4.220	+1.764	+0.709	25	53
TANZ.	FA	60	32.383	0.458	3.552	+1.232	-0.029	22	42
TANZ.	MJ	38	31.263	0.423	2.606	+0.342	-0.005	26	38
TANZ.	FJ	32	32.594	0.615	3.481	+0.067	+0.369	27	41
HEHE	MA	66	33.333	0.404	3.279	+0.515	-0.484	25	41
HEHE	FA	45	32.778	0.520	3.490	+1.965	-0.447	22	42
HEHE	MJ	28	32.000	0.436	2.309	+0.695	+0.272	27	38
HEHE	FJ	28	32.964	0.654	3.459	+0.264	+0.270	27	41
TUTSI	MA	10	31.000	0.596	1.886	-1.508	+0.373	29	34
TUTSI	FA	15	31.200	0.927	3.590	+3.190	+1.341	26	41
SUKUMA	MA	49	35.347	0.620	4.342	+6.041	+2.089	31	53
NYAK.	MA	64	38.047	0.447	3.574	+0.043	+0.398	31	48

Appendix 2(b) - Descriptive Statistics - Measurements using Profile View only

Table A2.14 - Nasal Prominence (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	290	30.007	0.302	5.146	-0.068	-0.204	16	44
ALL	FA	128	26.422	0.376	4.249	-0.547	-0.136	16	35
GB	MA	99	32.960	0.358	3.563	+0.656	-0.258	22	41
GB	FA	70	29.071	0.375	3.136	-0.305	-0.262	22	35
TANZ.	MA	191	28.476	0.375	5.181	+0.143	+0.141	16	44
TANZ.	FA	58	23.224	0.400	3.050	-0.583	-0.305	16	29
TANZ.	MJ	37	20.703	0.572	3.479	+1.413	-1.079	10	26
TANZ.	FJ	33	20.909	0.475	2.731	-0.605	-0.271	16	26
HEHE	MA	66	25.227	0.603	4.895	+1.488	+0.547	16	42
HEHE	FA	45	23.133	0.428	2.873	-0.552	-0.489	16	28
HEHE	MJ	28	20.536	0.683	3.616	+1.588	-1.315	10	25
HEHE	FJ	29	20.897	0.528	2.845	-0.730	-0.307	16	26
TUTSI	MA	11	25.182	0.961	3.188	+0.330	+0.477	20	31
TUTSI	FA	13	23.538	1.029	3.711	-0.835	-0.089	17	29
SUKUMA	MA	48	30.354	0.663	4.592	-0.490	+0.495	23	41
NYAK.	MA	65	31.000	0.500	4.027	+0.692	+0.352	22	44

Table A2.15 - Nasal Bridge Distance (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	15.249	0.306	5.206	-0.347	-0.033	2	29
ALL	FA	129	14.209	0.401	4.550	-0.555	-0.001	4	24
GB	MA	99	17.525	0.498	4.956	-0.154	-0.361	3	29
GB	FA	70	15.686	0.497	4.158	-0.555	-0.168	7	24
TANZ.	MA	190	14.063	0.359	4.944	+0.241	+0.090	2	27
TANZ.	FA	59	12.458	0.573	4.400	+0.047	+0.314	4	24
TANZ.	MJ	37	9.892	0.580	3.526	-0.112	-0.155	2	18
TANZ.	FJ	33	10.394	0.526	3.020	+0.507	+0.357	6	18
HEHE	MA	65	11.538	0.594	4.793	+0.742	+0.088	2	23
HEHE	FA	46	12.391	0.637	4.318	+0.439	+0.491	4	24
HEHE	MJ	28	9.536	0.670	3.543	+0.280	-0.118	2	18
HEHE	FJ	29	10.172	0.546	2.941	-0.008	+0.524	6	18
TUTSI	MA	11	14.909	1.194	3.961	+7.274	+2.525	12	26
TUTSI	FA	13	12.692	1.346	4.854	-1.042	-0.202	5	20
SUKUMA	MA	48	15.146	0.645	4.467	-0.319	+0.182	7	26
NYAK.	MA	65	15.631	0.583	4.702	-0.553	+0.184	7	27

Table A2.16 - Nasal Height (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	290	51.528	0.409	6.959	+0.123	+0.030	30	70
ALL	FA	129	47.287	0.493	5.602	+0.990	-0.277	27	63
GB	MA	99	53.545	0.472	4.698	+0.732	+0.035	40	65
GB	FA	70	49.614	0.596	4.988	+5.327	-0.871	27	63
TANZ.	MA	191	50.482	0.556	7.685	-0.096	+0.291	30	70
TANZ.	FA	59	44.525	0.656	5.036	+0.242	+0.233	32	58
TANZ.	MJ	37	41.811	0.808	4.915	+0.173	-0.129	31	54
TANZ.	FJ	33	41.152	0.913	5.245	+3.027	+1.252	32	59
HEHE	MA	66	45.742	0.695	5.650	+3.068	+0.586	30	68
HEHE	FA	46	44.500	0.760	5.154	+0.477	+0.365	32	58
HEHE	MJ	28	42.107	0.942	4.984	+0.581	-0.074	31	54
HEHE	FJ	29	41.448	1.020	5.494	+2.504	+1.108	32	59
TUTSI	MA	11	42.909	1.516	5.029	+0.787	+0.319	35	53
TUTSI	FA	13	44.615	1.328	4.788	-0.694	-0.419	36	51
SUKUMA	MA	48	52.271	1.039	7.199	-0.138	-0.071	36	67
NYAK.	MA	65	55.354	0.792	6.382	-0.344	+0.458	43	70

Table A2.17 - Height of Whole Upper Lip (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	24.235	0.223	3.784	+0.168	+0.451	14	36
ALL	FA	126	21.810	0.307	3.447	-0.088	+0.183	13	32
GB	MA	98	22.194	0.289	2.856	+0.450	+0.150	14	30
GB	FA	67	20.597	0.394	3.224	+1.650	+0.642	13	32
TANZ.	MA	191	25.283	0.274	3.780	-0.078	+0.354	18	36
TANZ.	FA	59	23.186	0.415	3.187	-0.390	-0.235	15	30
TANZ.	MJ	37	22.216	0.540	3.284	+0.261	-0.123	15	30
TANZ.	FJ	33	22.697	0.543	3.117	-0.848	+0.017	17	29
HEHE	MA	66	23.530	0.395	3.212	+2.439	+1.004	18	36
HEHE	FA	46	24.022	0.411	2.785	-0.371	-0.230	18	30
HEHE	MJ	28	22.929	0.628	3.321	+1.124	-0.560	15	30
HEHE	FJ	29	23.310	0.518	2.792	-0.620	-0.005	18	29
TUTSI	MA	11	23.091	0.744	2.468	+0.903	-0.712	18	27
TUTSI	FA	13	20.231	0.778	2.803	+0.974	+0.257	15	26
SUKUMA	MA	48	26.083	0.614	4.252	-0.366	+0.099	18	35
NYAK.	MA	65	26.892	0.401	3.231	+0.002	+0.051	19	26

Table A2.18 - Vertical Height of Lower Face (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	76.723	0.565	9.608	+0.691	+0.892	59	116
ALL	FA	129	67.395	0.599	6.805	+1.735	+0.872	53	94
GB	MA	98	71.214	0.535	5.298	+0.112	+0.440	59	86
GB	FA	70	64.114	0.589	4.927	+2.975	+0.894	43	84
TANZ.	MA	191	79.550	0.730	10.096	+0.116	+0.584	61	116
TANZ.	FA	59	71.288	0.872	6.701	+2.173	+0.743	57	94
TANZ.	MJ	37	65.234	0.877	5.334	+0.218	-0.466	52	75
TANZ.	FJ	33	66.485	1.158	6.653	-0.591	-0.294	53	77
HEHE	MA	66	73.242	1.089	8.851	+10.291	+2.673	61	116
HEHE	FA	46	72.239	1.004	6.812	+2.331	+0.730	57	94
HEHE	MJ	28	66.607	0.897	4.748	+0.738	-0.454	54	75
HEHE	FJ	29	67.759	1.123	6.054	0.503	-0.573	53	77
TUTSI	MA	11	70.364	1.422	4.717	-0.552	-0.719	62	76
TUTSI	FA	13	67.923	1.448	5.220	+0.657	+0.276	59	79
SUKUMA	MA	48	82.687	1.397	9.680	-0.487	0.221	63	103
NYAK.	MA	65	85.354	0.893	7.201	-0.753	+0.133	72	102

Table A2.19 - Height of Forehead above Eyebrows

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	290	61.110	0.607	10.330	+0.102	+0.079	28	93
ALL	FA	118	56.831	0.812	8.818	+0.099	+0.304	35	83
GB	MA	99	60.768	0.923	9.185	+0.083	+0.557	45	87
GB	FA	60	57.117	1.287	9.966	-0.113	+0.482	38	83
TANZ.	MA	191	61.288	0.788	10.895	+0.066	-0.082	28	93
TANZ.	FA	58	56.534	0.988	7.526	-0.171	-0.230	35	70
TANZ.	MJ	37	57.504	1.235	7.511	-0.564	-0.056	42	72
TANZ.	FJ	33	59.515	1.063	6.109	+0.133	+0.507	48	75
HEHE	MA	66	52.561	1.196	9.715	+3.781	+0.799	28	93
HEHE	FA	45	55.800	1.151	7.721	-0.153	-0.156	35	70
HEHE	MJ	28	54.714	1.178	6.235	-0.484	-0.137	42	67
HEHE	FJ	29	59.552	1.182	6.367	+0.027	+0.503	48	75
TUTSI	MA	11	59.364	2.273	7.540	-0.215	+0.069	47	73
TUTSI	FA	13	59.077	1.785	6.435	-0.414	-0.219	48	70
SUKUMA	MA	48	67.375	1.098	7.609	-0.189	-0.547	48	81
NYAK.	MA	65	65.892	1.082	8.727	-0.298	+0.436	50	87

Table A2.20 - Height of Upper Face

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	290	75.417	0.559	9.519	+0.539	+0.485	45	107
ALL	FA	128	68.477	0.518	5.855	-0.465	+0.202	56	85
GB	MA	99	71.283	0.642	6.387	+3.028	-0.789	45	87
GB	FA	69	67.449	0.655	5.438	+0.080	+0.482	56	82
TANZ.	MA	191	77.560	0.735	10.162	-0.265	+0.347	51	107
TANZ.	FA	59	69.678	0.799	6.138	-0.552	-0.135	58	85
TANZ.	MJ	37	65.324	0.955	5.887	-0.288	+0.053	54	79
TANZ.	FJ	33	66.333	1.024	5.883	-0.764	-0.397	55	75
HEHE	MA	66	71.591	0.868	7.054	+1.175	+0.127	51	93
HEHE	FA	46	70.804	0.831	5.636	-0.246	-0.122	59	85
HEHE	MJ	28	66.500	1.090	5.770	+0.190	-0.254	54	79
HEHE	FJ	29	67.621	0.930	5.010	+0.016	-0.528	55	75
TUTSI	MA	11	66.000	1.168	3.873	-1.463	-0.379	60	71
TUTSI	FA	13	65.592	1.774	6.393	-1.053	+0.373	58	76
SUKUMA	MA	48	81.750	1.505	10.340	-0.554	-0.061	59	103
NYAK.	MA	65	82.662	1.055	8.510	-0.337	+0.452	69	107

Table A2.21 - Orbit - Auricle Distance (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	90.671	0.616	10.469	-0.255	+0.594	68	120
ALL	FA	128	81.344	0.565	6.387	+1.840	+0.711	66	105
GB	MA	99	83.333	0.630	6.269	+0.545	+0.445	68	102
GB	FA	70	78.729	0.681	5.695	+5.788	+1.192	66	105
TANZ.	MA	190	94.495	0.739	10.184	-0.614	+0.368	74	120
TANZ.	FA	58	84.500	0.755	5.753	+1.147	+0.718	74	104
TANZ.	MJ	37	82.838	0.898	5.465	-0.691	-0.233	71	92
TANZ.	FJ	33	82.879	1.194	6.859	-0.132	-0.792	68	93
HEHE	MA	65	87.354	0.885	7.134	+3.584	+1.367	74	116
HEHE	FA	45	85.711	0.827	5.546	+1.453	+0.799	76	104
HEHE	MJ	28	83.857	0.938	4.964	-0.649	-0.223	74	92
HEHE	FJ	29	84.414	1.048	5.641	+1.274	-1.016	68	93
TUTSI	MA	11	83.818	1.271	4.215	-1.079	-0.325	77	89
TUTSI	FA	13	80.308	1.237	4.461	+1.847	+0.845	74	91
SUKUMA	MA	48	98.042	1.327	9.193	-0.739	+0.064	79	117
NYAK.	MA	65	100.969	1.006	8.111	-0.283	+0.286	85	120

Table A2.22 - Auricle Chin Distance (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	150.512	1.110	18.877	-0.278	+0.686	108	205
ALL	FA	128	131.727	1.010	11.425	-0.419	+0.261	105	161
GB	MA	98	136.735	0.827	8.192	+0.940	-0.316	108	155
GB	FA	70	124.843	1.017	8.505	+3.746	+0.947	105	161
TANZ.	MA	191	157.581	1.369	18.913	-0.745	+0.278	118	205
TANZ.	FA	58	140.034	1.136	8.651	-0.410	-0.116	120	159
TANZ.	MJ	37	131.405	1.579	9.602	+0.489	-0.513	105	149
TANZ.	FJ	33	131.333	1.770	10.212	-0.331	-0.432	109	149
HEHE	MA	66	142.348	1.482	12.042	+4.575	+1.430	118	194
HEHE	FA	45	141.356	1.123	7.532	-0.579	-0.138	127	155
HEHE	MJ	28	132.821	1.819	9.623	+1.502	-0.802	105	149
HEHE	FJ	29	133.379	1.675	9.017	+0.883	-0.650	109	149
TUTSI	MA	11	138.818	2.075	6.882	-1.140	-0.235	128	148
TUTSI	FA	13	135.462	3.016	10.875	+0.358	+0.694	120	159
SUKUMA	MA	48	165.104	2.348	16.267	-0.522	+0.038	136	205
NYAK.	MA	65	171.062	1.645	13.265	-0.373	+0.369	145	203

Table A2.23 - Height of Face (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	129.405	0.830	14.105	+0.269	+0.609	102	108
ALL	FA	129	115.752	0.760	8.627	+1.633	+0.811	99	148
GB	MA	98	126.735	0.745	7.372	-0.253	+0.034	108	143
GB	FA	70	115.671	0.972	8.129	+4.134	+1.377	102	148
TANZ.	MA	191	130.775	1.185	16.378	-0.517	+0.389	102	180
TANZ.	FA	59	115.847	1.205	9.253	-0.072	+0.354	99	142
TANZ.	MJ	37	108.351	1.453	8.836	+0.278	-0.632	87	123
TANZ.	FJ	33	108.091	1.701	9.770	+0.045	+0.146	88	128
HEHE	MA	66	118.682	1.437	11.678	+11.544	+2.672	103	180
HEHE	FA	46	116.696	1.380	9.357	+0.014	+0.249	99	142
HEHE	MJ	28	110.000	1.522	8.055	+0.446	-0.562	91	123
HEHE	FJ	29	109.828	1.658	8.929	+0.320	+0.233	91	128
TUTSI	MA	11	113.727	2.236	7.417	+2.539	+1.079	102	131
TUTSI	FA	13	112.846	2.369	8.543	+0.655	+0.808	102	132
SUKUMA	MA	48	135.708	2.055	14.235	-0.638	+0.119	108	166
NYAK.	MA	65	142.708	1.390	11.208	+0.314	+0.337	120	173

Table A2.24 - Columella Length (mm)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	289	9.104	0.170	2.890	+0.443	+0.513	2	19
ALL	FA	129	8.372	0.190	2.162	+1.866	+0.762	3	16
GB	MA	98	9.847	0.275	2.722	+0.050	+0.318	4	18
GB	FA	70	8.971	0.280	2.340	+1.351	+0.866	4	16
TANZ.	MA	191	8.723	0.210	2.906	+0.895	+0.680	2	19
TANZ.	FA	59	7.661	0.220	1.688	-0.194	-0.355	3	11
TANZ.	MJ	37	6.730	0.316	1.924	-0.573	+0.061	3	11
TANZ.	FJ	33	6.697	0.303	1.741	+0.021	+0.726	4	11
HEHE	MA	66	7.788	0.309	2.509	+3.506	+1.213	3	18
HEHE	FA	46	7.826	0.243	1.651	-0.632	-0.237	4	11
HEHE	MJ	28	6.893	0.376	1.988	-0.387	-0.085	3	11
HEHE	FJ	29	6.759	0.343	1.845	-0.361	+0.601	4	11
TUTSI	MA	11	7.000	0.726	2.408	-0.384	+0.368	3	11
TUTSI	FA	13	7.077	0.487	1.754	+0.982	-0.794	3	9
SUKUMA	MA	48	9.333	0.433	2.999	+0.483	+0.518	4	18
NYAK.	MA	65	9.523	0.368	2.969	+0.801	+0.394	2	19

APPENDIX 2(c) - DESCRIPTIVE STATISTICS - ANGLES (From Profile View)

Table A2.25 - Nasal Angle (degrees)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	373	59.166	0.295	5.702	-0.067	-0.179	40	74
ALL	FA	152	60.836	0.399	4.924	-0.361	-0.008	49	72
GB	MA	99	62.374	0.433	4.304	+0.102	-0.101	51	74
GB	FA	70	62.471	0.513	4.293	-0.399	-0.071	51	72
TANZ.	MA	274	58.007	0.345	5.707	-0.018	-0.017	40	73
TANZ.	FA	82	59.439	0.554	5.021	-0.132	+0.246	49	72
TANZ.	MJ	40	59.475	0.741	4.685	+0.034	-0.145	48	69
TANZ.	FJ	35	60.343	0.798	4.721	+1.355	+0.660	52	75
HEHE	MA	112	59.089	0.553	5.850	-0.425	+0.051	47	73
HEHE	FA	62	58.903	0.621	4.891	-0.332	+0.129	49	70
HEHE	MJ	31	58.645	0.792	4.409	+0.349	-0.245	48	68
HEHE	FJ	31	60.000	0.875	4.872	+1.613	+0.860	52	75
TUTSI	MA	11	54.364	2.051	6.801	-0.814	-0.046	43	65
TUTSI	FA	13	59.846	1.377	4.964	+0.828	+0.688	53	71
SUKUMA	MA	48	55.750	0.720	4.987	+1.302	-0.533	40	65
NYAK.	MA	84	58.464	0.636	5.826	-0.492	-0.061	45	70
KINGA	MA	19	57.421	0.537	2.341	+0.075	-0.077	52	62

Table A2.26 - Nasal Base Angle (degrees)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	373	8.359	0.303	5.848	-0.448	+0.107	-7	+25
ALL	FA	152	6.099	0.393	4.843	-0.372	+0.210	-4	+19
GB	MA	99	3.475	0.416	4.141	+0.289	+0.435	-7	+15
GB	FA	70	3.386	0.451	3.774	-0.164	+0.324	-4	+13
TANZ.	MA	274	10.124	0.323	5.354	-0.134	-0.045	-3	+25
TANZ.	FA	82	8.415	0.491	4.450	-0.009	-0.055	-3	+19
TANZ.	MJ	40	9.500	0.559	3.537	-0.073	-0.016	+1	+16
TANZ.	FJ	35	8.371	0.561	3.317	-0.842	-0.260	+2	+14
HEHE	MA	112	8.955	0.527	5.579	-0.387	+0.020	-3	+22
HEHE	FA	62	8.952	0.557	4.389	-0.197	+0.077	-1	+19
HEHE	MJ	31	9.839	0.690	3.839	-0.299	-0.208	+1	+16
HEHE	FJ	31	8.613	0.602	3.353	-0.678	-0.405	+2	+14
TUTSI	MA	11	11.182	1.361	4.513	-0.022	-0.385	+3	+18
TUTSI	FA	13	8.386	0.924	3.330	-0.923	-0.206	+3	+13
SUKUMA	MA	48	11.938	0.616	4.265	+1.170	+0.514	+3	+25
NYAK.	MA	84	10.262	0.633	5.798	-0.507	+0.079	-2	+23
KINGA	MA	19	11.211	0.716	3.119	+1.148	-0.096	+4	+18

Table A2.27 - Upper Lip Angle (degrees)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	373	21.504	0.783	15.125	-0.097	-0.568	-22	+55
ALL	FA	152	14.237	1.471	18.139	-1.025	-0.042	-25	+51
GB	MA	99	2.051	1.085	10.799	+0.686	+0.374	-22	+35
GB	FA	70	-2.457	1.089	9.111	+0.639	-0.052	-25	+24
TANZ.	MA	274	28.533	0.551	9.113	+0.196	+0.242	+3	+55
TANZ.	FA	82	28.488	1.083	9.808	-0.439	+0.095	+5	+51
TANZ.	MJ	40	32.025	1.450	9.172	+0.809	+0.475	+16	+60
TANZ.	FJ	35	32.114	1.671	0.884	-0.973	-0.063	+13	+48
HEHE	MA	112	27.205	0.895	9.475	-0.031	+0.116	+3	+54
HEHE	FA	62	27.419	1.227	0.659	-0.595	+0.062	+5	+46
HEHE	MJ	31	31.290	1.375	7.656	-0.684	-0.086	+16	+44
HEHE	FJ	31	32.287	1.729	9.625	-0.904	-0.035	+13	+48
TUTSI	MA	11	31.091	3.067	10.173	+0.266	+1.009	+20	+52
TUTSI	FA	13	34.154	2.835	10.221	+0.143	-0.014	+14	+51
SUKUMA	MA	48	28.333	0.950	6.580	+0.141	+0.331	+16	+46
NYAK.	MA	84	29.690	1.047	9.594	+0.130	+0.346	+10	+55
KINGA	MA	19	30.263	2.134	9.303	+0.012	-0.012	+12	+47

Table A2.28 - Chin Angle (degrees)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	-10.298	0.281	5.412	+1.129	-0.243	-37	+5
ALL	FA	152	-9.671	0.431	5.316	+0.327	-0.282	-28	+2
GB	MA	98	-11.133	0.523	5.177	-0.574	+0.240	-20	+3
GB	FA	70	-11.057	0.632	5.286	+0.777	-0.227	-28	+2
TANZ.	MA	274	-10.000	0.331	5.473	+1.780	-0.409	-37	+5
TANZ.	FA	82	-8.488	0.561	5.080	+0.140	-0.331	-24	+2
TANZ.	MJ	40	-10.400	0.810	5.123	-0.818	+0.403	-18	0
TANZ.	FJ	35	-10.514	0.713	4.217	-1.276	-0.154	-17	-4
HEHE	MA	112	-9.527	0.570	6.033	+2.728	-0.857	-37	+3
HEHE	FA	62	-7.919	0.602	4.740	-0.501	-0.141	-19	+2
HEHE	MJ	31	-9.581	0.927	5.163	-0.971	+0.281	-18	0
HEHE	FJ	31	-10.613	0.747	4.161	-1.265	-0.077	-17	-4
TUTSI	MA	11	-12.000	1.572	5.215	+0.462	+0.879	-19	-1
TUTSI	FA	13	-10.615	1.745	6.292	+0.995	-0.274	-24	0
SUKUMA	MA	48	-9.208	0.682	4.726	-0.171	-0.278	-22	-1
NYAK.	MA	84	-10.821	0.554	5.078	+1.167	-0.147	-29	+3
KINGA	MA	19	-10.000	1.231	4.364	+2.394	+1.204	-18	+5

Table A2.29 - Frontal Recession Angle (degrees)

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	74.159	0.317	6.115	+0.263	+0.167	56	93
ALL	FA	149	77.141	0.506	6.174	-0.357	-0.193	59	89
GB	MA	98	76.704	0.628	6.215	+0.855	-0.610	56	88
GB	FA	67	79.881	0.622	5.095	-0.587	-364	69	89
TANZ.	MA	274	73.248	0.352	5.825	+0.774	+0.434	57	93
TANZ.	FA	82	74.902	0.674	6.101	+0.094	+0.121	59	89
TANZ.	MJ	40	76.525	0.675	4.267	-0.275	+0.384	69	87
TANZ.	FJ	35	76.886	0.803	4.751	-0.762	-0.411	68	85
HEHE	MA	112	73.723	0.521	5.510	+0.046	+0.432	63	89
HEHE	FA	62	74.742	0.743	5.848	+0.180	-0.098	59	88
HEHE	MJ	31	77.355	0.757	4.215	-0.548	+0.337	70	87
HEHE	FJ	31	76.613	0.812	4.522	-0.528	-0.354	68	85
TUTSI	MA	11	71.182	1.887	6.258	-0.766	-0.097	61	81
TUTSI	FA	13	73.769	1.854	6.685	+0.207	+0.527	64	88
SUKUMA	MA	48	71.958	0.863	5.982	+2.039	+0.830	61	93
NYAK.	MA	84	73.810	0.667	6.110	+1.035	+0.595	60	93
KINGA	MA	19	72.421	1.243	5.419	+2.290	-1.185	57	79

APPENDIX 2(d) - RELATIONSHIPS - DESCRIPTIVE STATISTICS

Table A2.30 - Nasal Wing/Septum Relationship (%)

CAT	SS	n	o/o 0	+/+ 1	+/- 2	-/+ 3	-/- 4	+/o 5	o/+ 6	o/- 7	-/o 8
ALL	MA	373	0.0	82.6	5.4	0.8	0.0	9.7	1.3	0.0	0.3
ALL	FA	153	0.0	69.9	11.1	0.0	0.0	17.6	1.3	0.0	0.0
GB	MA	99	0.0	66.7	12.1	1.0	0.0	20.2	0.0	0.0	0.0
GB	FA	70	0.0	55.7	12.7	0.0	0.0	31.4	0.0	0.0	0.0
TANZ.	MA	274	0.0	88.3	2.9	0.7	0.0	5.8	1.8	0.0	0.4
TANZ.	FA	83	0.0	81.9	9.6	0.0	0.0	6.0	2.4	0.0	0.0
TANZ.	MJ	40	0.0	80.0	7.5	0.0	0.0	7.5	5.0	0.0	0.0
TANZ.	FJ	35	0.0	97.1	0.0	0.0	0.0	2.9	0.0	0.0	0.0
HEHE	MA	112	0.0	81.3	5.4	1.8	0.0	7.1	3.6	0.0	0.9
HEHE	FA	63	0.0	76.2	12.7	0.0	0.0	7.9	3.2	0.0	0.0
HEHE	MJ	31	0.0	74.2	9.7	0.0	0.0	9.7	6.5	0.0	0.0
HEHE	FJ	31	0.0	96.8	0.0	0.0	0.0	3.2	0.0	0.0	0.0
TUTSI	MA	11	0.0	81.8	0.0	0.0	0.0	18.2	0.0	0.0	0.0
TUTSI	FA	13	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUKUMA	MA	48	0.0	97.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
NYAK.	MA	84	0.0	90.5	2.4	0.0	0.0	7.1	0.0	0.0	0.0
KINGA	MA	19	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table A2.31 - Relationships To Vertical Facial Plane (%)

		Frontal Protraction/Retraction				Nasal Protraction/Retraction			
CAT	SS	n	PRO.	RET.	VERT.	n	PRO.	RET.	VERT.
ALL	MA	373	57.9	41.0	1.1	373	20.4	78.0	1.6
ALL	FA	153	65.4	26.1	8.5	153	15.7	81.7	2.6
GB	MA	99	52.5	43.4	4.0	99	2.0	97.0	1.0
GB	FA	70	61.4	21.4	17.1	70	2.0	95.7	1.4
TANZ.	MA	274	59.9	40.1	0.0	274	27.0	71.2	1.8
TANZ.	FA	83	68.7	30.1	1.2	83	26.5	69.9	3.6
TANZ.	MJ	40	77.5	20.0	2.5	40	35.0	55.0	10.0
TANZ.	FJ	35	71.4	25.7	2.9	35	20.0	71.4	8.6
HEHE	MA	112	67.9	32.1	0.0	112	28.6	70.5	0.9
HEHE	FA	63	68.3	30.2	1.6	63	31.7	63.5	4.8
HEHE	MJ	31	77.4	19.4	3.2	31	45.2	41.9	12.9
HEHE	FJ	31	74.2	22.6	3.2	31	22.6	67.7	9.7
TUTSI	MA	11	54.5	45.5	0.0	11	9.1	90.9	0.0
TUTSI	FA	13	53.8	46.2	0.0	13	7.7	92.3	0.0
SUKUMA	MA	48	54.2	45.8	0.0	48	25.0	75.0	0.0
NYAK	MA	84	59.5	40.5	0.0	84	28.6	67.9	3.6
KINGA	MA	19	31.6	68.4	0.0	19	26.3	68.4	5.3

Table A2.31 - Relationships To Vertical Facial Plane (%) Continued

		Labial Protraction/Retraction				Mandibular Protraction/Retraction			
CAT	SS	n	PRO.	RET.	VERT.	n	PRO.	RET.	VERT.
ALL	MA	373	83.4	14.5	2.1	373	30.4	62.6	6.7
ALL	FA	153	70.6	20.3	9.2	153	24.8	68.6	6.5
GB	MA	99	42.4	49.5	8.1	98	6.1	81.6	11.2
GB	FA	70	35.7	44.3	20.0	70	8.6	82.9	8.6
TANZ.	MA	274	98.2	1.8	0.0	274	39.1	55.8	5.1
TANZ.	FA	83	100.0	0.0	0.0	83	38.6	56.6	4.8
TANZ.	MJ	40	100.0	0.0	0.0	40	27.5	70.0	2.5
TANZ.	FJ	35	100.0	0.0	0.0	35	25.7	51.4	22.9
HEHE	MA	112	96.4	3.6	0.0	112	40.2	50.0	9.8
HEHE	FA	63	100.0	0.0	0.0	63	41.3	54.0	4.8
HEHE	MJ	31	100.0	0.0	0.0	31	35.5	61.3	3.2
HEHE	FJ	31	100.0	0.0	0.0	31	25.8	48.4	25.8
TUTSI	MA	11	100.0	0.0	0.0	11	18.2	81.8	0.0
TUTSI	FA	13	100.0	0.0	0.0	13	38.5	61.5	0.0
SUKUMA	MA	48	100.0	0.0	0.0	48	43.8	56.3	0.0
NYAK	MA	84	98.8	1.2	0.0	84	38.1	59.5	2.4
KYAK	MA	19	100.0	0.0	0.0	19	36.8	57.9	5.3

APPENDIX 2(e) - DESCRIPTIVE STATISTICS - INDICES USING FRONT VIEW ONLY

Table A2.32 - Ear Protrusion Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	0.844	0.002	0.043	-0.135	-0.192	0.720	0.946
ALL	FA	152	0.844	0.003	0.041	+0.207	+0.389	0.748	0.977
GB	MA	99	0.807	0.004	0.037	+0.611	+0.367	0.720	0.933
GB	FA	69	0.826	0.004	0.033	+0.477	+0.420	0.748	0.918
TANZ.	MA	272	0.857	0.002	0.037	+0.488	-0.247	0.729	0.946
TANZ.	FA	83	0.860	0.005	0.041	+0.334	+0.153	0.751	0.977
TANZ.	MJ	41	0.833	0.006	0.037	-0.308	+0.125	0.759	0.916
TANZ.	FJ	34	0.828	0.006	0.035	+0.203	-0.049	0.746	0.904
HEHE	MA	111	0.852	0.003	0.035	+0.078	-0.019	0.764	0.934
HEHE	FA	61	0.869	0.005	0.041	+0.197	+0.008	0.770	0.977
HEHE	MJ	31	0.841	0.007	0.036	+0.012	-0.099	0.762	0.916
HEHE	FJ	30	0.831	0.006	0.032	+0.249	+0.234	0.767	0.904
TUTSI	MA	10	0.828	0.014	0.043	+2.678	-1.388	0.729	0.882
TUTSI	FA	15	0.828	0.008	0.029	+2.451	-1.062	0.751	0.876
SUKUMA	MA	49	0.846	0.006	0.041	+0.510	-0.379	0.745	0.945
NYAK.	MA	83	0.871	0.003	0.031	-0.767	+0.257	0.817	0.946
KINGA	MA	19	0.862	0.008	0.036	-0.416	+0.134	0.799	0.938

Table A2.33 - Mouth Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	348	2.607	0.042	0.776	+9.027	+2.389	1.636	7.750
ALL	FA	127	2.790	0.083	0.940	+5.225	+1.904	1.395	7.500
GB	MA	96	3.458	0.097	0.947	+4.950	+1.738	2.103	7.750
GB	FA	59	3.419	0.131	1.008	+3.667	+1.643	2.125	7.500
TANZ.	MA	252	2.283	0.021	0.331	+0.408	+0.655	1.636	3.450
TANZ.	FA	68	2.244	0.044	0.361	+0.115	+0.368	1.395	3.105
TANZ.	MJ	34	2.312	0.062	0.062	-0.704	+0.440	1.679	3.045
TANZ.	FJ	31	2.206	0.056	0.312	-0.879	+0.062	1.667	2.792
HEHE	MA	104	2.359	0.032	0.326	+0.430	+0.604	1.636	3.450
HEHE	FA	55	2.249	0.050	0.370	+0.139	+0.437	1.395	3.105
HEHE	MJ	29	2.346	0.066	0.356	-0.851	+0.484	1.813	3.045
HEHE	FJ	30	2.200	0.058	0.315	-0.895	+0.118	1.667	2.792
TUTSI	MA								
TUTSI	FA								
SUKUMA	MA	48	2.218	0.046	0.316	+1.710	+0.768	1.651	3.296
NYAK.	MA	79	2.253	0.037	0.333	+0.335	+0.775	1.750	3.286
KINGA	MA	18	2.174	0.077	0.327	+0.534	+0.779	1.676	2.963

Table A2.34 - Lip Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	356	0.912	0.014	0.265	+7.579	+1.272	0.214	2.667
ALL	FA	137	0.830	0.020	0.232	+0.455	+0.292	0.300	1.667
GB	MA	96	0.745	0.038	0.372	+10.891	+2.809	0.214	2.667
GB	FA	59	0.694	0.029	0.225	+4.763	+1.387	0.300	1.667
TANZ.	MA	260	0.974	0.011	0.176	-0.215	+0.253	0.556	1.545
TANZ.	FA	78	0.932	0.020	0.180	-0.453	+0.218	0.588	1.364
TANZ.	MJ	36	0.958	0.033	0.197	+1.094	+0.980	0.647	1.444
TANZ.	FJ	33	0.912	0.029	0.166	-0.503	-0.286	0.571	1.182
HEHE	MA	107	0.982	0.017	0.177	-0.025	+0.353	0.650	1.545
HEHE	FA	60	0.939	0.024	0.189	-0.643	+0.280	0.588	1.364
HEHE	MJ	30	0.958	0.037	0.205	+1.167	+1.015	0.647	1.444
HEHE	FJ	30	0.917	0.029	0.160	-01172	-0.390	0.571	1.182
TUTSI	MA								
TUTSI	FA	11	0.837	0.040	0.131	-0.546	-0.761	0.588	1.000
SUKUMA	MA	48	0.951	0.025	0.174	-0.132	+0.346	0.556	1.385
NYAK.	MA	80	0.976	0.020	0.182	-0.451	+0.197	0.600	1.385
KINGA	MA	18	0.965	0.035	0.148	+1.940	-0.944	0.611	1.250

Table A2.35 - Eye Fissure Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	368	3.073	0.028	0.534	+1.917	+1.002	1.263	5.286
ALL	FA	151	3.195	0.050	0.611	+1.293	+1.084	2.200	5.333
GB	MA	98	3.409	0.069	0.680	-0.341	+0.646	2.286	4.286
GB	FA	67	3.495	0.081	0.665	+0.243	+0.876	2.357	5.333
TANZ.	MA	270	2.951	0.025	0.408	+1.381	+0.246	1.263	4.333
TANZ.	FA	84	2.956	0.048	0.437	+0.304	+0.657	2.200	4.250
TANZ.	MJ	41	3.030	0.076	0.490	-0.374	+0.249	2.200	4.125
TANZ.	FJ	33	2.892	0.063	0.359	-0.131	+0.364	2.154	3.667
HEHE	MA	110	3.139	0.035	0.367	+1.439	+0.601	2.185	4.333
HEHE	FA	62	2.988	0.059	0.463	+0.123	+0.621	2.200	4.250
HEHE	MJ	31	3.180	0.079	0.440	-0.005	+0.209	2.231	4.125
HEHE	FJ	29	2.917	0.065	0.352	-0.398	+0.581	2.296	3.667
TUTSI	MA	10	2.885	0.127	0.402	+0.112	+0.894	2.417	3.667
TUTSI	FA	15	2.809	0.071	0.276	-1.095	+0.017	2.333	3.250
SUKUMA	MA	49	2.692	0.052	0.364	+0.354	+0.711	2.125	3.700
NYAK.	MA	83	2.888	0.038	0.350	+1.400	+0.660	2.083	4.000
KINGA	MA	18	2.831	0.122	0.516	+5.417	-1.110	1.263	3.923

Table A2.36 - Occular Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	2.844	0.017	0.334	+2.868	+1.031	1.935	4.500
ALL	FA	154	2.860	0.025	0.315	+0.195	+0.223	2.063	3.913
GB	MA	99	2.989	0.036	0.360	+4.050	+1.071	1.935	4.500
GB	FA	70	3.006	0.035	0.293	+1.228	+0.003	2.063	3.913
TANZ.	MA	272	2.972	0.019	0.309	+2.182	+0.975	2.130	4.167
TANZ.	FA	84	2.738	0.030	0.280	+0.361	+0.424	2.122	3.571
TANZ.	MJ	41	2.708	0.028	0.181	+0.755	+0.608	2.370	3.235
TANZ.	FJ	34	2.778	0.052	0.302	+0.625	+0.503	2.200	3.613
HEHE	MA	111	2.772	0.026	0.279	+0.842	+0.394	2.143	3.828
HEHE	FA	62	2.734	0.033	0.262	-0.017	+0.165	2.122	3.400
HEHE	MJ	31	2.714	0.033	0.183	+1.156	+0.483	2.370	3.235
HEHE	FJ	30	2.779	0.059	0.321	+0.231	+0.463	2.200	3.613
TUTSI	MA	10	2.784	0.097	0.307	+2.522	-0.490	2.130	3.333
TUTSI	FA	15	2.750	0.058	0.225	-0.671	+0.066	2.381	3.097
SUKUMA	MA	49	2.756	0.039	0.270	+0.544	+0.358	2.269	3.563
NYAK.	MA	83	2.830	0.037	0.337	+1.457	+1.267	2.350	3.971
KINGA	MA	19	2.837	0.100	0.436	+3.964	+1.562	2.229	4.167

Table A2.37 - Mouth Width Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	353	2.289	0.014	0.268	+0.784	+0.825	1.753	3.304
ALL	FA	137	2.440	0.024	0.282	+0.785	+0.494	1.762	3.390
GB	MA	99	2.547	0.026	0.262	+0.167	+0.384	1.918	3.304
GB	FA	69	2.570	0.029	0.242	+2.239	+0.912	1.987	3.390
TANZ.	MA	254	2.189	0.012	0.093	+1.088	+0.598	1.753	2.944
TANZ.	FA	68	2.307	0.031	0.258	+0.935	+0.760	1.762	3.132
TANZ.	MJ	34	2.290	0.033	0.190	+0.065	+0.085	1.871	2.702
TANZ.	FJ	31	2.286	0.031	0.172	+2.875	+1.316	2.058	2.863
HEHE	MA	105	2.203	0.021	0.214	+1.184	+0.764	1.800	2.944
HEHE	FA	55	2.295	0.035	0.257	+1.390	+0.907	1.762	3.132
HEHE	MJ	29	2.264	0.034	0.184	-0.031	+0.086	1.871	2.655
HEHE	FJ	30	2.284	0.032	0.175	+2.816	+1.340	2.058	2.863
TUTSI	MA								
TUTSI	FA								
SUKUMA	MA	48	2.120	0.023	0:160	+0.159	+0.168	1.758	2.483
NYAK.	MA	80	2.189	0.020	0.176	+0.200	+0.154	1.753	2.618
KINGA	MA	18	2.290	0.041	0.176	+0.890	+1.111	2.074	2.700

Table A2.38 - Nasal Breadth Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	3.086	0.021	0.405	-0.036	+0.828	2.344	4.257
ALL	FA	154	3.314	0.035	0.432	-0.493	+0.462	2.518	4.485
GB	MA	99	3.624	0.028	0.283	-0.441	+0.188	2.958	4.257
GB	FA	70	3.682	0.037	0.309	-0.044	+0.474	3.067	4.485
TANZ.	MA	272	2.890	0.014	0.226	+1.309	+0.644	2.344	3.864
TANZ.	FA	84	3.008	0.026	0.236	+0.082	+0.572	2.518	3.735
TANZ.	MJ	41	3.075	0.043	0.277	-0.236	+0.451	2.593	3.703
TANZ.	FJ	34	3.057	0.031	0.183	+2.059	+0.681	2.750	3.650
HEHE	MA	111	2.859	0.020	0.214	+0.753	+0.321	2.349	3.558
HEHE	FA	62	2.965	0.026	0.203	-0.602	+0.330	2.518	3.370
HEHE	MJ	31	3.043	0.052	0.289	+0.106	+0.655	2.593	3.703
HEHE	FJ	30	3.047	0.034	0.186	+2.551	+0.834	2.750	3.650
TUTSI	MA	10	3.141	0.072	0.229	-0.229	+0.462	2.818	3.564
TUTSI	FA	15	3.210	0.073	0.281	-0.881	+0.197	2.809	3.735
SUKUMA	MA	48	2.914	0.031	0.214	+1.283	+0.264	2.344	3.574
NYAK.	MA	83	2.893	0.026	0.234	+2.419	+0.989	2.469	3.864
KINGA	MA	18	2.866	0.051	0.224	+3.107	+1.771	2.614	3.475

Table A2.39 - Inter-Occular Width Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	4.018	0.027	0.524	+5.024	+1.206	2.826	7.500
ALL	FA	154	4.054	0.041	0.514	+0.178	+0.519	3.063	5.870
GB	MA	99	4.432	0.055	0.545	+9.479	+2.018	3.488	7.500
GB	FA	70	4.390	0.056	0.465	+0.903	+0.342	3.063	5.870
TANZ.	MA	272	3.868	0.026	0.427	+0.891	+0.599	2.826	5.633
TANZ.	FA	84	3.774	0.040	0.365	-0.495	+0.458	3.143	4.500
TANZ.	MJ	41	3.680	0.042	0.270	-0.280	+0.058	3.130	4.294
TANZ.	FJ	34	3.765	0.063	0.367	+0.572	+0.368	2.978	4.742
HEHE	MA	111	3.816	0.036	0.381	-0.598	-0.000	3.027	4.828
HEHE	FA	62	3.763	0.046	0.363	-0.403	+0.590	3.154	4.600
HEHE	MJ	31	3.703	0.049	0.270	+0.191	-0.191	3.130	4.294
HEHE	FJ	30	3.759	0.070	0.386	+0.378	+0.404	2.978	4.742
TUTSI	MA	10	3.807	0.159	0.504	+1.114	-0.124	2.826	4.633
TUTSI	FA	15	3.790	0.088	0.341	-0.674	-0.421	3.143	4.258
SUKUMA	MA	49	3.846	0.052	0.361	+0.187	+0.152	3.019	4.781
NYAK.	MA	83	3.932	0.050	0.457	+0.200	+0.834	3.058	5.167
KINGA	MA	19	3.977	0.141	0.614	+1.617	+0.989	3.104	5.633

Table A2.40 - Biocular Width Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	1.413	0.004	0.084	+2.166	+0.814	1.180	1.865
ALL	FA	154	1.417	0.007	0.081	-0.066	-0.191	1.178	1.632
GB	MA	99	1.485	0.009	0.087	+3.147	+0.590	1.239	1.865
GB	FA	70	1.461	0.008	0.069	+3.196	-1.028	1.178	1.600
TANZ.	MA	272	1.387	0.004	0.065	+1.506	+0.465	1.180	1.644
TANZ.	FA	84	1.381	0.008	0.073	+0.627	+0.342	1.214	1.632
TANZ.	MJ	41	1.359	0.007	0.045	-0.661	+0.335	1.286	1.457
TANZ.	FJ	34	1.359	0.012	0.073	-0.466	-0.293	1.202	1.481
HEHE	MA	111	1.378	0.006	0.063	+1.281	+0.478	1.231	1.621
HEHE	FA	62	1.379	0.010	0.076	+0.886	+0.544	1.214	1.632
HEHE	MJ	31	1.365	0.009	0.048	-1.029	+0.104	1.286	1.457
HEHE	FJ	30	1.356	0.014	0.075	-0.648	-0.249	1.202	1.481
TUTSI	MA	10	1.366	0.025	0.078	+0.703	+1.000	1.278	1.527
TUTSI	FA	15	1.378	0.015	0.056	+1.894	-0.594	1.241	1.484
SUKUMA	MA	49	1.397	0.009	0.061	+2.023	+0.691	1.273	1.604
NYAK.	MA	83	1.391	0.007	0.067	+2.570	+0.270	1.180	1.644
KINGA	MA	19	1.403	0.016	0.068	+0.275	+0.943	1.326	1.570

Table A2.41 - Mouth-Nose Width Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	353	1.354	0.008	0.148	+1.011	+0.553	0.977	1.895
ALL	FA	137	1.375	0.013	0.157	+0.526	+0.060	0.883	1.829
GB	MA	99	1.435	0.016	0.164	+0.666	+0.649	0.977	1.895
GB	FA	69	1.443	0.017	0.138	+0.485	+0.076	1.070	1.829
TANZ.	MA	254	1.323	0.008	0.129	+0.089	+0.135	1.000	1.739
TANZ.	FA	68	1.306	0.018	0.145	+1.712	+0.236	0.883	1.816
TANZ.	MJ	34	1.331	0.024	0.137	+1.525	+0.885	1.074	1.763
TANZ.	FJ	31	1.340	0.016	0.088	-0.368	+0.173	1.173	1.523
HEHE	MA	105	1.306	0.013	0.135	+0.233	+0.109	1.000	1.739
HEHE	FA	55	1.303	0.018	0.134	+0.564	-0.508	0.883	1.565
HEHE	MJ	29	1.337	0.027	0.145	+1.130	+0.773	1.074	1.763
HEHE	FJ	30	1.338	0.016	0.089	-0.323	+0.243	1.173	1.523
TUTSI	MA								
TUTSI	FA								
SUKUMA	MA	48	1.379	0.017	0.119	+0.742	+0.296	1.074	1.723
NYAK.	MA	80	1.324	0.014	0.123	-0.401	+0.124	1.038	1.600
KINGA	MA	18	1.240	0.018	0.076	-0.086	-0.294	1.075	1.360

Table A2.42 - Bioccular - Mouth Width Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	353	1.619	0.009	0.163	+0.605	+0.675	1.286	2.196
ALL	FA	137	1.715	0.015	0.173	+0.783	+0.395	1.310	2.264
GB	MA	99	1.717	0.017	0.170	+0.527	+0.469	1.286	2.196
GB	FA	69	1.760	0.019	0.157	+0.968	+0.403	1.360	2.209
TANZ.	MA	254	1.581	0.009	0.144	+0.624	+0.668	1.297	2.111
TANZ.	FA	68	1.669	0.022	0.178	+1.293	+0.644	1.310	2.264
TANZ.	MJ	34	1.686	0.024	0.140	+0.278	+0.045	1.371	2.000
TANZ.	FJ	31	1.687	0.029	0.160	+1.154	+0.846	1.406	2.115
HEHE	MA	105	1.604	0.016	0.161	+0.384	+0.672	1.313	2.111
HEHE	FA	55	1.666	0.024	0.180	+1.699	+0.845	1.310	2.264
HEHE	MJ	29	1.665	0.025	0.135	+0.179	+0.019	1.371	1.966
HEHE	FJ	30	1.689	0.030	0.163	+1.024	+0.799	1.406	2.115
TUTSI	MA								
TUTSI	FA								
SUKUMA	MA	48	1.519	0.015	0.106	+0.408	+0.154	1.297	1.820
NYAK.	MA	80	1.576	0.015	0.136	-0.152	+0.466	1.313	1.925
KINGA	MA	18	1.640	0.029	0.124	+1.883	+0.683	1.426	1.965

Table A2.43 - Interoccular - Nasal Width Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	0.775	0.005	0.103	+0.209	+0.209	0.492	1.095
ALL	FA	154	0.824	0.008	0.103	+0.100	+0.170	0.561	1.171
GB	MA	99	0.828	0.011	0.105	+0.787	-0.056	0.500	1.079
GB	FA	70	0.847	0.013	0.106	+0.493	+0.170	0.561	1.171
TANZ.	MA	270	0.755	0.006	0.096	+0.371	+0.458	0.492	1.095
TANZ.	FA	84	0.804	0.011	0.097	-0.405	+0.081	0.583	1.029
TANZ.	MJ	41	0.839	0.014	0.091	-0.478	-0.195	0.630	1.000
TANZ.	FJ	34	0.818	0.014	0.080	-0.192	-0.086	0.657	1.000
HEHE	MA	111	0.756	0.009	0.093	+0.441	+0.624	0.537	1.022
HEHE	FA	62	0.795	0.012	0.091	-0.463	+0.185	0.610	1.000
HEHE	MJ	31	0.825	0.016	0.086	-0.076	-0.171	0.630	1.000
HEHE	FJ	30	0.818	0.015	0.084	-0.441	-0.072	0.657	1.000
TUTSI	MA	10	0.836	0.036	0.113	+3.079	+1.038	0.659	1.095
TUTSI	FA	15	0.853	0.026	0.101	-0.024	-0.149	0.660	1.029
SUKUMA	MA	49	0.965	0.014	0.095	-0.312	+0.485	0.607	0.963
NYAK.	MA	83	0.744	0.011	0.096	-0.177	+0.338	0.525	1.000
KINGA	MA	19	0.733	0.022	0.097	+1.058	-0.560	0.492	0.919

APPENDIX 2(2) - DESCRIPTIVE STATISTICS : INDICES USING PROFILE VIEW ONLY

Table A2.44 - Upper Face - Forehead Height Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	1.245	0.013	0.243	+3.220	+1.030	0.643	2.607
ALL	FA	142	1.235	0.020	0.244	+3.480	+1.136	0.753	2.429
GB	MA	99	1.202	0.022	0.223	-0.165	+0.129	0.643	1.761
GB	FA	60	1.215	0.031	0.240	+0.967	+0.609	0.753	2.000
TANZ.	MA	272	1.261	0.015	0.248	+3.787	+1.251	0.738	2.607
TANZ.	FA	82	1.250	0.027	0.248	+5.125	+1.503	0.857	2.429
TANZ.	MJ	40	1.170	0.034	0.218	+0.336	+0.572	0.786	1.789
TANZ.	FJ	35	1.119	0.023	0.138	-0.709	+0.022	0.821	1.373
HEHE	MA	111	1.323	0.028	0.295	+3.204	+1.272	0.783	2.607
HEHE	FA	62	1.290	0.033	0.260	+4.771	+1.400	0.857	2.429
HEHE	MJ	31	1.237	0.036	0.199	+0.789	+0.575	0.871	1.789
HEHE	FJ	31	1.139	0.024	0.133	-0.410	-0.162	0.821	1.373
TUTSI	MA	11	1.129	0.050	0.165	-0.864	+0.427	0.924	1.426
TUTSI	FA	13	1.122	0.041	0.147	-0.715	+0.631	0.952	1.396
SUKUMA	MA	48	1.225	0.026	0.180	-0.559	+0.186	0.877	1.609
NYAK.	MA	84	1.237	0.024	0.221	+0.217	+0.505	0.738	1.849
KINGA	MA	18	1.171	0.035	0.147	-0.409	-0.011	0.952	1.393

Table A2.45 - Upper-Lower Facial Height Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	0.982	0.006	0.113	+0.391	+0.182	0.643	1.353
ALL	FA	152	1.018	0.009	0.110	+0.901	+0.439	0.778	1.396
GB	MA	98	1.005	0.011	0.110	+0.866	-0.164	0.643	1.302
GB	FA	69	1.059	0.014	0.113	+0.757	+0.690	0.843	1.396
TANZ.	MA	274	0.973	0.007	0.113	+0.427	+0.311	0.667	1.353
TANZ.	FA	83	0.984	0.011	0.096	-0.115	-0.116	0.778	1.230
TANZ.	MJ	40	1.003	0.015	0.092	+0.777	+0.438	0.831	1.254
TANZ.	FJ	35	1.000	0.017	0.103	+1.771	+0.716	0.825	1.321
HEHE	MA	112	0.978	0.011	0.112	+0.627	+0.215	0.680	1.353
HEHE	FA	63	0.987	0.012	0.099	-0.161	-0.248	0.778	1.230
HEHE	MJ	31	1.002	0.017	0.094	+1.341	+0.468	0.831	1.254
HEHE	FJ	31	1.000	0.020	0.110	+1.235	+0.664	0.825	1.321
TUTSI	MA	11	0.941	0.021	0.071	+0.725	+0.109	0.811	1.079
TUTSI	FA	13	0.969	0.023	0.083	+4.020	+1.311	0.829	1.188
SUKUMA	MA	48	0.993	0.016	0.110	+1.419	+0.705	0.811	1.338
NYAK.	MA	84	0.969	0.013	0.119	-0.377	+0.403	0.745	1.306
KINGA	MA	19	0.933	0.026	0.113	+0.414	-0.590	0.667	1.115

Table A2.46 - Lower Face - Forhead Height Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	370	1.271	0.012	0.225	+4.667	+1.155	0.761	2.714
ALL	FA	142	1.221	0.018	0.217	+1.854	+0.877	0.790	2.143
GB	MA	98	1.196	0.020	0.198	-0.125	+0.315	0.765	1.717
GB	FA	60	1.152	0.026	0.201	+0.789	+0.567	0.790	1.816
TANZ.	MA	272	1.298	0.014	0.228	+5.499	+1.356	0.761	2.714
TANZ.	FA	82	1.271	0.024	0.215	+2.385	+1.164	0.887	2.143
TANZ.	MJ	40	1.166	0.029	0.184	-0.269	-0.134	0.722	1.500
TANZ.	FJ	35	1.125	0.024	0.139	-0.618	+0.532	0.891	1.415
HEHE	MA	111	1.355	0.026	0.275	+4.895	+1.416	0.761	2.714
HEHE	FA	62	1.309	0.029	0.226	+1.871	+1.037	0.942	2.143
HEHE	MJ	31	1.233	0.026	0.143	-0.498	+0.204	0.970	1.500
HEHE	FJ	31	1.145	0.024	0.134	-0.756	+0.502	0.955	1.415
TUTSI	MA	11	1.207	0.060	0.199	-1.432	-0.084	0.939	1.500
TUTSI	FA	13	1.158	0.031	0.113	-0.375	+0.629	1.029	1.396
SUKUMA	MA	48	1.238	0.024	0.169	-0.778	+0.330	0.929	1.609
NYAK.	MA	84	1.279	0.020	0.186	+0.936	+0.575	0.852	1.880
KINGA	MA	18	1.260	0.042	0.179	+0.045	-0.055	0.897	1.620

Table A2.47 - Lower Face Proportion Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	370	3.134	0.019	0.373	+0.535	+0.447	2.219	4.643
ALL	FA	150	3.123	0.030	0.365	+0.489	+0.257	2.036	4.154
GB	MA	97	3.251	0.040	0.394	+1.180	+0.755	2.483	4.643
GB	FA	67	3.159	0.044	0.364	+0.528	+0.435	2.370	4.154
TANZ.	MA	273	3.093	0.022	0.356	-0.124	+0.251	2.219	4.300
TANZ.	FA	83	3.094	0.040	0.365	+0.539	+0.311	2.036	4.067
TANZ.	MJ	40	2.981	0.057	0.358	+1.496	+1.128	2.367	4.067
TANZ.	FJ	35	2.947	0.049	0.288	-0.357	+0.746	2.560	3.579
HEHE	MA	111	3.049	0.033	0.345	-0.217	+0.482	2.407	3.889
HEHE	FA	63	3.052	0.043	0.338	+0.351	-0.045	2.036	3.760
HEHE	MJ	31	2.952	0.067	0.375	+2.082	+1.326	2.367	4.067
HEHE	FJ	31	2.922	0.052	0.292	+0.057	+0.981	2.560	3.579
TUTSI	MA	11	3.071	0.090	0.299	-0.473	-0.198	2.520	3.500
TUTSI	FA	13	3.399	0.110	0.398	-0.982	+0.562	2.875	4.067
SUKUMA	MA	48	3.212	0.054	0.373	+1.003	+0.198	2.219	4.300
NYAK.	MA	84	3.097	0.041	0.374	-0.606	-0.013	2.381	3.857
KINGA	MA	19	3.043	0.064	0.280	+0.541	+0.009	2.469	3.667

Table A2.48 - Nasal Height - Prominence Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	373	1.767	0.014	0.276	+1.904	+0.964	1.250	3.000
ALL	FA	152	1.846	0.022	0.270	+4.442	+0.879	0.900	3.222
GB	MA	99	1.642	0.022	0.218	+2.304	+1.038	1.250	2.423
GB	FA	70	1.721	0.026	0.214	+2.287	-0.373	0.900	2.174
TANZ.	MA	274	1.812	0.017	0.281	+1.861	+0.910	1.250	3.000
TANZ.	FA	82	1.950	0.030	0.270	+4.273	+1.396	1.346	3.222
TANZ.	MJ	40	2.063	0.052	0.327	+6.249	+1.606	1.385	3.400
TANZ.	FJ	35	2.014	0.050	0.297	-0.881	+0.230	1.462	2.625
HEHE	MA	112	1.848	0.031	0.327	+1.689	+0.906	1.250	3.000
HEHE	FA	62	1.959	0.037	0.291	+4.932	+1.479	1.346	3.222
HEHE	MJ	31	2.093	0.058	0.323	+8.124	+2.175	1.640	3.400
HEHE	FJ	31	2.034	0.056	0.309	-1.031	+0.058	1.462	2.625
TUTSI	MA	11	1.725	0.082	0.271	-0.905	+0.247	1.367	2.200
TUTSI	FA	13	1.916	0.052	0.188	-0.089	-0.792	1.517	2.125
SUKUMA	MA	48	1.740	0.035	0.241	+0.433	+0.677	1.390	2.444
NYAK.	MA	84	1.812	0.024	0.222	+1.660	+0.983	1.400	2.667
KINGA	MA	19	1.835	0.067	0.293	-0.827	+0.156	1.357	2.375

Table A2.49 - Nasal Prominence - Bridge Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	2.250	0.056	1.073	+19.659	+3.759	0.846	9.667
ALL	FA	152	2.100	0.063	0.777	+4.381	+1.757	1.083	6.000
GB	MA	99	2.106	0.113	1.124	+30.602	+5.123	1.207	9.667
GB	FA	70	1.979	0.065	0.542	+2.486	+1.418	1.158	3.857
TANZ.	MA	273	2.302	0.064	1.051	+16.009	+3.258	0.846	9.500
TANZ.	FA	82	2.203	0.102	0.923	+2.847	+1.508	1.083	6.000
TANZ.	MJ	40	2.455	0.253	1.603	+10.773	+3.085	1.111	9.500
TANZ.	FJ	35	2.128	0.110	0.654	+0.789	+1.105	1.286	4.000
HEHE	MA	111	2.510	0.124	1.307	+12.155	+2.940	0.846	9.500
HEHE	FA	62	2.220	0.118	0.927	+3.729	+1.658	1.083	6.000
HEHE	MJ	31	2.548	0.318	1.768	+8.829	+2.888	1.111	9.500
HEHE	FJ	31	2.159	0.118	0.658	+0.885	+1.113	1.236	4.000
TUTSI	MA	11	1.747	0.097	0.320	-0.941	-0.220	1.192	2.167
TUTSI	FA	13	2.165	0.281	1.014	+1.098	+1.402	1.176	4.400
SUKUMA	MA	48	2.156	0.093	0.646	+2.780	+1.519	1.192	4.429
NYAK.	MA	84	2.166	0.070	0.642	+2.592	+1.311	1.235	4.750
KINGA	MA	19	2.383	0.369	1.610	+4.071	+2.410	1.333	7.000

Table A2.50 - Whole Upper Lip Vertical Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	2.119	0.021	0.400	+1.660	+0.812	1.034	4.143
ALL	FA	150	2.190	0.037	0.456	+1.809	+0.971	1.333	4.154
GB	MA	98	2.455	0.041	0.405	+2.195	+0.921	1.724	4.143
GB	FA	67	2.467	0.056	0.458	+2.193	+0.725	1.350	4.154
TANZ.	MA	273	1.998	0.020	0.323	+0.632	+0.480	1.034	3.350
TANZ.	FA	83	1.966	0.034	0.307	+2.037	+0.945	1.333	3.200
TANZ.	MJ	40	1.917	0.049	0.308	-0.231	+0.512	1.467	2.667
TANZ.	FJ	35	1.835	0.045	0.268	-0.847	-0.047	1.280	2.360
HEHE	MA	111	1.964	0.030	0.217	+0.864	+0.477	1.034	2.857
HEHE	FA	63	1.912	0.033	0.262	+0.139	+0.453	1.333	2.571
HEHE	MJ	31	1.875	0.053	0.297	+0.083	+0.596	1.467	2.667
HEHE	FJ	31	1.796	0.047	0.260	-0.511	+0.175	1.280	2.360
TUTSI	MA	11	1.881	0.099	0.328	-0.865	+0.799	1.519	2.400
TUTSI	FA	13	2.239	0.104	0.275	+2.490	+1.404	1.810	3.200
SUKUMA	MA	48	2.043	0.053	0.370	+1.829	+0.859	1.444	3.350
NYAK.	MA	84	2.030	0.032	0.291	-0.579	+0.191	1.472	2.652
KINGA	MA	19	2.013	0.081	0.355	-0.886	+0.057	1.407	2.591

Table A2.51 - Lower Facial Height Vertical Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	1.510	0.011	0.216	+1.459	+0.696	1.063	2.467
ALL	FA	153	1.461	0.019	0.236	+1.292	+0.799	1.000	2.344
GB	MA	98	1.338	0.014	0.140	-0.152	+0.369	1.063	1.750
GB	FA	70	1.306	0.021	0.177	+9.214	+1.970	1.000	2.222
TANZ.	MA	274	1.571	0.012	0.205	+2.049	+0.767	1.092	2.567
TANZ.	FA	83	1.592	0.022	0.198	+2.091	+1.983	1.250	2.344
TANZ.	MJ	40	1.575	0.030	0.192	-0.832	-0.119	1.182	1.889
TANZ.	FJ	35	1.626	0.031	0.185	-0.335	+0.057	1.237	2.000
HEHE	MA	112	1.578	0.020	0.212	+4.070	+1.179	1.117	2.567
HEHE	FA	63	1.611	0.024	0.194	+2.823	+1.346	1.289	2.344
HEHE	MJ	31	1.592	0.033	0.183	-0.774	-0.189	1.241	1.871
HEHE	FJ	31	1.646	0.033	0.186	-0.177	-0.139	1.237	2.000
TUTSI	MA	11	1.660	0.069	0.228	-1.168	+0.444	1.396	2.056
TUTSI	FA	13	1.538	0.056	0.203	+1.370	+0.953	1.255	2.000
SUKUMA	MA	48	1.600	0.031	0.213	+0.314	+0.437	1.092	2.167
NYAK.	MA	84	1.540	0.019	0.176	+0.017	+0.101	1.101	2.043
KINGA	MA	19	1.544	0.054	0.233	+0.846	+0.764	1.158	2.132

Table A2.52 - Nasal Columella Length Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	6.400	0.116	2.234	+15.379	+2.631	2.611	25.500
ALL	FA	153	6.038	0.123	1.516	+4.314	+1.516	3.000	13.000
GB	MA	98	5.855	0.177	1.750	+1.131	+1.158	3.313	11.250
GB	FA	70	5.851	0.172	1.443	+1.671	+0.732	3.000	11.250
TANZ.	MA	274	6.595	0.142	2.356	+15.986	+2.780	2.611	25.500
TANZ.	FA	83	6.196	0.172	1.566	+5.663	+2.051	4.091	13.000
TANZ.	MJ	40	6.640	0.305	1.930	+0.199	+0.878	4.000	11.500
TANZ.	FJ	35	6.528	0.285	1.686	+1.657	+0.960	3.455	11.000
HEHE	MA	112	6.637	0.210	2.220	+3.510	+1.578	3.000	15.333
HEHE	FA	63	6.066	0.185	1.465	+4.577	+1.908	4.091	12.000
HEHE	MJ	31	6.499	0.319	1.779	+0.676	+1.081	4.200	11.333
HEHE	FJ	31	6.561	0.320	1.783	+1.184	+0.873	3.455	11.000
TUTSI	MA	11	6.920	0.885	2.934	+3.837	+1.670	3.500	14.333
TUTSI	FA	13	6.762	0.611	2.205	+5.280	+2.020	4.500	13.000
SUKUMA	MA	48	6.101	0.271	1.876	+1.886	+1.176	2.611	12.000
NYAK.	MA	84	6.733	0.307	2.813	+23.599	+3.917	3.316	25.500
KINGA	MA	19	6.800	0.359	1.566	-0.359	+0.119	3.727	9.500

Table A2.53 - Lateral Proportion Index I

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	1.648	0.006	0.108	+0.106	+0.091	1.366	2.056
ALL	FA	152	1.620	0.008	0.093	+0.886	-0.259	1.296	1.894
GB	MA	98	1.645	0.011	0.113	-0.595	+0.019	1.373	1.882
GB	FA	70	1.590	0.012	0.104	+0.945	+0.051	1.296	1.894
TANZ.	MA	273	1.650	0.006	0.106	+0.424	+0.127	1.366	2.056
TANZ.	FA	82	1.647	0.008	0.073	-0.118	+0.038	1.469	1.817
TANZ.	MJ	40	1.584	0.012	0.076	-0.326	+0.015	1.419	1.734
TANZ.	FJ	35	1.591	0.017	0.100	+0.326	+0.389	1.400	1.868
HEHE	MA	111	1.609	0.009	0.100	-0.126	+0.139	1.407	1.902
HEHE	FA	62	1.643	0.009	0.072	+0.070	-0.089	1.469	1.800
HEHE	MJ	31	1.581	0.014	0.077	-0.242	-0.046	1.419	1.733
HEHE	FJ	31	1.586	0.018	0.102	+0.467	+0.462	1.400	1.868
TUTSI	MA	11	1.658	0.021	0.071	+0.510	+0.272	1.547	1.800
TUTSI	FA	13	1.686	0.020	0.072	-0.927	+0.094	1.577	1.817
SUKUMA	MA	48	1.686	0.013	0.093	-0.084	-0.034	1.485	1.933
NYAK.	MA	84	1.685	0.012	0.109	+0.982	+0.340	1.406	2.056
KINGA	MA	19	1.635	0.024	0.103	+1.602	-0.859	1.366	1.803

Table A2.54 - Lateral Proportion Index II

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	1.429	0.007	0.130	+0.943	+0.263	0.855	1.944
ALL	FA	152	1.422	0.010	0.118	+2.448	+0.969	1.151	1.894
GB	MA	98	1.526	0.012	0.122	-0.602	-0.179	1.225	1.765
GB	FA	70	1.475	0.015	0.128	+2.063	+1.003	1.200	1.894
TANZ.	MA	273	1.394	0.007	0.115	+2.985	+0.299	0.855	1.944
TANZ.	FA	82	1.377	0.010	0.088	-0.417	+0.020	1.151	1.583
TANZ.	MJ	40	1.308	0.013	0.083	+0.779	+0.881	1.207	1.564
TANZ.	FJ	35	1.317	0.020	0.120	+1.124	+0.889	1.141	1.684
HEHE	MA	111	1.363	0.010	0.103	+4.317	-0.829	0.855	1.608
HEHE	FA	62	1.370	0.011	0.083	-0.303	-0.176	1.151	1.543
HEHE	MJ	31	1.311	0.016	0.086	+0.739	+0.865	1.207	1.564
HEHE	FJ	31	1.315	0.022	0.123	+1.279	+0.958	1.141	1.684
TUTSI	MA	11	1.360	0.032	0.108	-1.476	+0.254	1.227	1.526
TUTSI	FA	13	1.406	0.026	0.093	-1.079	-0.495	1.244	1.538
SUKUMA	MA	48	1.386	0.014	0.098	+3.396	+1.272	1.223	1.764
NYAK.	MA	84	1.440	0.014	0.124	+2.226	+0.788	1.175	1.944
KINGA	MA	19	1.417	0.028	0.121	+0.249	-0.669	1.146	1.606

Table A2.55 - Lateral Proportion Index III

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	1.160	0.005	0.100	+4.774	+0.798	0.897	1.831
ALL	FA	152	1.145	0.008	0.096	-0.023	-0.090	0.837	1.382
GB	MA	98	1.081	0.008	0.075	+0.113	+0.102	0.897	1.280
GB	FA	79	1.082	0.009	0.077	+2.366	+0.093	0.837	1.333
TANZ.	MA	274	1.188	0.006	0.092	+7.837	+1.256	0.960	1.831
TANZ.	FA	82	1.199	0.008	0.075	+0.017	-0.208	0.987	1.382
TANZ.	MJ	40	1.215	0.013	0.082	-0.461	+0.181	1.049	1.413
TANZ.	FJ	35	1.213	0.014	0.081	-0.752	-0.009	1.047	1.383
HEHE	MA	111	1.187	0.010	0.103	+12.524	+2.136	0.960	1.831
HEHE	FA	62	1.203	0.009	0.072	-0.501	-0.205	1.042	1.364
HEHE	MJ	31	1.210	0.016	0.087	-0.529	+0.293	1.049	1.413
HEHE	FJ	31	1.211	0.015	0.082	-0.616	+0.041	1.047	1.383
TUTSI	MA	11	1.224	0.025	0.088	-0.903	+0.448	1.118	1.382
TUTSI	FA	13	1.203	0.023	0.082	+0.678	+0.603	1.083	1.382
SUKUMA	MA	48	1.220	0.011	0.075	-0.971	+0.101	1.073	1.366
NYAK.	MA	84	1.175	0.009	0.085	-0.163	+0.028	0.990	1.413
KINGA	MA	19	1.157	0.015	0.067	+0.855	+0.658	1.046	1.318

Table A2.56 - Nasal Prominence Lateral Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	372	4.174	0.046	0.886	+0.376	+0.465	3.341	8.529
ALL	FA	152	5.260	0.087	1.070	-0.347	+0.465	3.471	8.294
GB	MA	98	4.186	0.041	0.409	+1.887	+0.734	3.341	4.773
GB	FA	70	4.335	0.057	0.476	-0.179	+0.586	3.471	5.522
TANZ.	MA	274	5.528	0.044	0.730	+1.478	+0.869	3.862	8.529
TANZ.	FA	82	6.050	0.083	0.755	+0.653	+0.871	4.643	8.294
TANZ.	MJ	40	6.495	0.170	1.072	+4.776	+1.921	5.040	10.500
TANZ.	FJ	35	6.406	0.144	0.849	+0.772	+0.779	4.917	8.813
HEHE	MA	112	5.602	0.078	0.825	+0.633	+0.109	4.026	8.529
HEHE	FA	62	6.124	0.090	0.706	+0.380	+0.868	5.000	8.222
HEHE	MJ	31	6.619	0.203	1.130	+4.265	+1.941	5.333	10.500
HEHE	FJ	31	6.513	0.149	0.831	+0.746	+0.798	5.250	8.813
TUTSI	MA	11	5.579	0.194	0.643	-1.069	+0.389	4.774	6.650
TUTSI	FA	13	5.882	0.284	1.002	+1.373	+1.200	4.643	8.294
SUKUMA	MA	48	5.515	0.101	0.698	+0.229	+0.661	4.300	7.200
NYAK.	MA	84	5.468	0.072	0.663	+0.185	+0.253	3.862	7.231
KINGA	MA	19	5.358	0.117	0.511	-0.813	-0.454	4.308	6.000

Table A2.57 - Nasal Bridge Distance Lateral Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	371	11.706	0.320	6.171	+15.867	+3.197	4.731	59.000
ALL	FA	152	11.098	0.402	4.960	+3.899	+1.728	5.333	34.500
GB	MA	98	8.813	0.490	4.850	+28.950	+4.830	4.966	42.667
GB	FA	70	8.628	0.331	2.772	+2.772	+1.788	5.333	18.143
TANZ.	MA	273	12.744	0.379	6.270	+16.147	+3.196	4.731	59.000
TANZ.	FA	82	13.206	0.600	5.436	+2.496	+1.461	5.708	34.500
TANZ.	MJ	40	15.812	1.681	10.629	+12.850	+3.301	7.556	65.500
TANZ.	FJ	35	13.541	0.687	4.063	-0.197	+0.636	7.333	23.167
HEHE	MA	111	14.098	0.763	8.037	+11.354	+2.843	4.731	59.000
HEHE	FA	62	13.485	0.702	5.527	+3.054	+1.590	5.708	34.500
HEHE	MJ	31	16.677	2.103	11.709	+10.458	+3.050	7.556	65.500
HEHE	FJ	31	13.931	0.717	3.995	-0.149	+0.645	7.333	23.167
TUTSI	MA	11	9.698	0.520	1.724	+2.009	-1.105	5.692	11.750
TUTSI	FA	13	12.557	1.593	5.745	+0.107	+1.183	7.450	24.600
SUKUMA	MA	48	11.863	0.546	3.786	+2.885	+1.468	6.654	25.571
NYAK.	MA	84	11.893	0.430	3.943	+0.371	+0.938	5.588	22.250
KINGA	MA	19	12.591	1.866	8.132	+6.822	+2.570	6.111	39.500

Table A2.58 - General Facial Size Factor Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	286	5.244	0.030	0.509	-0.025	+0.811	4.330	6.850
ALL	FA	127	4.703	0.026	0.295	+1.275	+0.960	4.200	5.780
GB	MA	98	4.835	0.020	0.198	+1.191	-0.030	4.330	5.500
GB	FA	70	4.581	0.028	0.234	+9.113	+1.994	4.200	5.780
TANZ.	MA	188	5.405	0.040	0.547	-0.691	+0.296	4.370	6.850
TANZ.	FA	57	4.853	0.039	0.294	-0.156	+0.347	4.290	5.630
TANZ.	MJ	37	4.629	0.045	0.276	-0.164	-0.457	4.020	5.100
TANZ.	FJ	32	4.618	0.054	0.306	-0.110	-0.916	3.930	5.040
HEHE	MA	65	4.980	0.043	0.348	+10.724	+2.554	4.400	6.760
HEHE	FA	44	4.925	0.041	0.274	+0.255	+0.276	4.370	5.630
HEHE	MJ	28	4.710	0.045	0.236	+1.116	-0.699	4.070	5.100
HEHE	FJ	28	4.695	0.045	0.237	+2.023	-1.255	3.980	5.040
TUTSI	MA	10	4.698	0.067	0.213	-0.595	+0.242	4.370	5.070
TUTSI	FA	13	4.608	0.062	0.225	+2.744	+1.396	4.290	5.180
SUKUMA	MA	48	5.581	0.063	0.439	-0.728	-0.103	4.690	6.430
NYAK.	MA	64	5.827	0.046	0.367	+0.348	+0.611	5.100	6.850

Table A2.59 - Nasal Bridge Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	286	2.919	0.060	1.008	-0.307	+0.079	0.455	5.743
ALL	FA	127	3.051	0.088	0.996	-0.700	-0.015	0.789	5.085
GB	MA	98	3.554	0.098	0.972	+0.273	-0.435	0.642	5.743
GB	FA	70	3.429	0.108	0.907	-0.747	-0.233	1.458	5.085
TANZ.	MA	188	2.587	0.063	0.125	+0.405	+0.041	0.455	5.128
TANZ.	FA	57	2.588	0.120	0.906	-0.065	+0.286	0.789	4.969
TANZ.	MJ	37	2.147	0.127	0.775	-0.101	-0.133	0.425	3.805
TANZ.	FJ	32	2.284	0.121	0.684	-0.341	+0.543	1.242	3.922
HEHE	MA	65	2.308	0.115	0.927	-0.905	-0.023	0.455	4.175
HEHE	FA	44	2.544	0.134	0.889	+0.592	+0.504	0.789	4.969
HEHE	MJ	28	2.025	0.139	0.737	+0.467	-0.205	0.425	3.805
HEHE	FJ	28	2.191	0.118	0.623	+0.555	+0.686	1.242	3.922
TUTSI	MA	13	3.218	0.230	0.727	+6.261	+2.328	2.632	5.128
TUTSI	FA	28	2.735	0.273	0.985	-1.133	-0.390	1.114	4.107
SUKUMA	MA	48	2.707	0.109	0.755	-0.158	+0.279	1.188	4.491
NYAK.	MA	64	2.672	0.100	0.804	-0.383	+0.305	1.299	4.576

Table A2.60 - Nasal Prominence Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	286	5.750	0.057	0.964	-0.324	+0.211	3.333	8.529
ALL	FA	127	5.648	0.090	1.014	-0.772	-0.109	3.249	7.746
GB	MA	98	6.673	0.069	0.679	+1.037	-0.089	4.453	8.529
GB	FA	70	6.351	0.079	0.660	-0.106	-0.254	4.792	7.746
TANZ.	MA	188	5.267	0.051	0.700	+0.494	+0.121	3.333	7.570
TANZ.	FA	57	4.784	0.084	0.633	-0.124	-0.147	3.249	6.237
TANZ.	MJ	37	4.461	0.109	0.664	+1.707	-0.771	2.457	5.814
TANZ.	FJ	32	4.528	0.104	0.587	-0.521	-0.039	3.333	5.797
HEHE	MA	65	5.077	0.101	0.815	+0.802	+0.339	3.333	7.570
HEHE	FA	44	4.690	0.086	0.571	-0.365	-0.515	3.249	5.640
HEHE	MJ	28	4.338	0.120	0.636	+1.652	-1.318	2.457	5.128
HEHE	FJ	28	4.439	0.105	0.554	-0.797	-0.071	3.333	5.439
TUTSI	MA	10	5.358	0.192	0.607	-1.338	-0.037	4.405	6.135
TUTSI	FA	13	5.105	0.207	0.745	-0.429	-0.212	3.720	6.237
SUKUMA	MA	48	5.437	0.097	0.672	-0.473	+0.379	4.167	6.861
NYAK.	MA	64	5.316	0.072	0.572	+0.003	+0.077	4.097	6.973

Table A2.61 - Nasal Index

POP.	CAT	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
ALL	MA	288	1.066	0.014	0.236	-0.134	+0.669	0.556	1.730
ALL	FA	128	1.144	0.023	0.256	-0.757	+0.253	0.643	1.758
GB	MA	99	1.327	0.017	0.168	-0.334	+0.477	1.000	1.730
GB	FA	70	1.321	0.023	0.189	+1.591	-0.231	0.643	1.758
TANZ.	MA	189	0.929	0.009	0.125	+0.405	+0.182	0.556	1.359
TANZ.	FA	58	0.931	0.017	0.132	+1.946	+1.073	0.679	1.382
TANZ.	MJ	37	0.920	0.022	0.134	-0.148	+0.616	0.683	1.222
TANZ.	FJ	32	0.906	0.020	0.113	+1.539	+0.720	0.720	1.255
HEHE	MA	66	0.878	0.015	0.119	+0.120	-0.037	0.556	1.140
HEHE	FA	45	0.886	0.013	0.089	+0.358	+0.124	0.679	1.091
HEHE	MJ	28	0.887	0.021	0.113	+0.683	+0.613	0.683	1.184
HEHE	FJ	28	0.894	0.022	0.115	+2.212	+0.985	0.720	1.255
TUTSI	MA	10	1.031	0.051	0.160	+0.899	+0.800	0.814	1.359
TUTSI	FA	13	1.087	0.039	0.141	-0.130	+0.784	0.929	1.382
SUKUMA	MA	48	0.953	0.018	0.124	-0.215	+0.111	0.706	1.220
NYAK.	MA	64	0.945	0.013	0.108	+0.027	+0.185	0.672	1.207

Appendix 3(a) - Mann-Whitney U Test Results using Measurements From Front View only

Table A3.1 - Bizygomatic Diameter

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	245.29	ALL	FA	130	131.56	0.0000	✓	✓
TANZANIA	MA	190	169.90	G.B.	MA	99	97.22	0.0000	✓	✓
TANZANIA	FA	60	75.38	G.B.	FA	70	57.03	0.0056	✓	✓
G.B.	MA	99	102.72	G.B.	FA	70	59.94	0.0000	✓	✓
N.E.G.B.	MA	35	54.87	REST G.B.	MA	64	47.34	0.2115	X	X
N.E.G.B.	FA	19	39.53	REST G.B.	FA	51	34.00	0.3116	X	X
N.E.G.B.	MA	35	31.40	N.E.G.B.	FA	19	20.32	0.0133	✓	X
REST G.B.	MA	64	71.59	REST G.B.	FA	51	40.95	0.0000	✓	✓
TANZANIA	MA	190	140.86	TANZANIA	FA	60	76.88	0.0000	✓	✓
TANZANIA	MA	190	127.78	TANZANIA	MJ	38	48.08	0.0000	✓	✓
TANZANIA	FA	60	50.30	TANZANIA	FJ	32	39.38	0.0615	X	X
TANZANIA	MJ	38	35.46	TANZANIA	FJ	32	35.55	0.9859	X	X
HEHE	MA	66	58.97	REST.TANZ	MA	124	114.94	0.0000	✓	✓
TUTSI	MA	10	10.75	REST.TANZ	MA	180	100.21	0.0000	✓	✓
SUKUMA	MA	49	104.86	REST.TANZ	MA	141	92.25	0.1666	X	X
NYAKYUSA	MA	64	140.57	REST.TANZ	MA	126	72.61	0.0000	✓	✓
HEHE	MA	66	56.66	HEHE	FA	45	55.03	0.7937	X	X
HEHE	MA	66	52.37	HEHE	MJ	28	36.02	0.0078	✓	✓
HEHE	FA	45	43.04	HEHE	FJ	28	27.29	0.0020	✓	✓
HEHE	MJ	28	30.50	HEHE	FJ	28	26.50	0.3581	X	X
TUTSI	MA	10	13.75	TUTSI	FA	15	12.50	0.6830	X	X
TUTSI	MA	10	11.00	TUTSI	MJ	8	7.63	0.2031	X	X
TUTSI	FA	15	11.70	TUTSI	FJ	4	3.63	0.0062	✓	✓
TUTSI	MJ	8	7.56	TUTSI	FJ	4	4.38	0.1453	X	X
HEHE	MA	66	42.87	TUTSI	MA	10	9.65	0.0000	✓	✓
HEHE	FA	45	36.61	TUTSI	FA	15	12.17	0.0000	✓	✓
HEHE	MA	66	43.10	SUKUMA	MA	49	78.07	0.0000	✓	✓
HEHE	MA	66	38.20	NYAKYUSA	MA	64	93.66	0.0000	✓	✓
TUTSI	MA	10	6.20	SUKUMA	MA	49	34.86	0.0000	✓	✓
TUTSI	MA	10	5.60	NYAKYUSA	MA	64	42.48	0.0000	✓	✓
SUKUMA	MA	49	42.07	NYAKYUSA	MA	64	68.43	0.0000	✓	✓

Table A8.2 - Biaural Breadth

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	247.51	ALL	FA	128	122.05	0.0000	√	√
TANZANIA	MA	190	148.22	G.B.	MA	99	133.83	0.3646	X	X
TANZANIA	FA	59	64.64	G.B.	FA	69	64.38	0.9876	X	X
G.B.	MA	99	104.77	G.B.	FA	69	55.41	0.0000	√	√
N.E.G.B.	MA	35	55.70	REST G.B.	MA	64	46.88	0.1440	X	X
N.E.G.B.	FA	19	42.00	REST G.B.	FA	50	32.34	0.0737	X	X
N.E.G.B.	MA	35	32.90	N.E.G.B.	FA	19	17.55	0.0006	√	√
REST G.B.	MA	64	72.08	REST G.B.	FA	50	38.84	0.0000	√	√
TANZANIA	MA	190	142.71	TANZANIA	FA	59	67.96	0.0000	√	√
TANZANIA	MA	190	126.75	TANZANIA	MJ	38	53.26	0.0000	√	√
TANZANIA	FA	59	45.74	TANZANIA	FJ	32	46.48	0.8974	X	X
TANZANIA	MJ	38	35.08	TANZANIA	FJ	32	36.00	0.8502	X	X
HEHE	MA	66	61.24	REST.TANZ.	MA	124	113.73	0.0000	√	√
TUTSI	MA	10	14.45	REST.TANZ.	MA	180	100.00	0.0000	√	√
SUKUMA	MA	49	114.42	REST.TANZ.	MA	141	88.93	0.0052	√	√
NYAKYUSA	MA	64	130.16	REST.TANZ.	MA	126	77.89	0.0000	√	√
HEHE	MA	66	60.39	HEHE	FA	44	48.17	0.0489	√	X
HEHE	MA	66	51.02	HEHE	MJ	28	39.21	0.0548	X	X
HEHE	FA	44	37.18	HEHE	FJ	28	35.43	0.7288	X	X
HEHE	MJ	28	29.48	HEHE	FJ	28	27.52	0.6518	X	X
TUTSI	MA	10	14.00	TUTSI	FA	15	12.33	0.6047	X	X
TUTSI	MA	10	10.25	TUTSI	MJ	8	8.56	0.5148	X	X
TUTSI	FA	15	10.90	TUTSI	FJ	4	6.63	0.1847	X	X
TUTSI	MJ	8	7.38	TUTSI	FJ	4	4.75	0.2328	X	X
HEHE	MA	66	42.25	TUTSI	MA	10	13.75	0.0001	√	√
HEHE	FA	44	34.42	TUTSI	FA	15	17.03	0.0007	√	√
HEHE	MA	66	43.10	SUKUMA	MA	49	78.07	0.0000	√	√
HEHE	MA	66	42.08	NYAKYUSA	MA	64	89.65	0.0000	√	√
TUTSI	MA	10	5.95	SUKUMA	MA	49	34.91	0.0000	√	√
TUTSI	MA	10	5.50	NYAKYUSA	MA	64	42.50	0.0000	√	√
SUKUMA	MA	49	50.45	NYAKYUSA	MA	64	62.02	0.0628	X	X

Table A3.8 - Nasal Breadth

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	240.75	ALL	FA	130	141.65	0.0000	✓	✓
TANZANIA	MA	190	191.97	G.B.	MA	99	54.36	0.0000	✓	✓
TANZANIA	FA	60	96.22	G.B.	FA	70	39.16	0.0000	✓	✓
G.B.	MA	99	100.16	G.B.	FA	70	63.56	0.0000	✓	✓
N.E.G.B.	MA	35	54.36	REST G.B.	MA	64	47.34	0.2107	X	X
N.E.G.B.	FA	19	36.05	REST G.B.	FA	51	35.29	0.8891	X	X
N.E.G.B.	MA	35	32.16	N.E.G.B.	FA	19	18.92	0.0029	✓	✓
REST G.B.	MA	64	67.79	REST G.B.	FA	51	45.72	0.0004	✓	✓
TANZANIA	MA	190	141.81	TANZANIA	FA	60	73.86	0.0000	✓	✓
TANZANIA	MA	190	127.47	TANZANIA	MJ	38	49.63	0.0000	✓	✓
TANZANIA	FA	60	50.83	TANZANIA	FJ	32	38.38	0.0326	✓	X
TANZANIA	MJ	38	35.91	TANZANIA	FJ	32	35.02	0.8456	X	X
HEHE	MA	66	71.10	REST.TANZ.	MA	124	108.49	0.0000	✓	✓
TUTSI	MA	10	8.35	REST.TANZ.	MA	180	100.34	0.0000	✓	✓
SUKUMA	MA	49	97.89	REST.TANZ.	MA	141	94.67	0.7238	X	X
NYAKYUSA	MA	64	133.91	REST.TANZ.	MA	126	75.99	0.0000	✓	✓
HEHE	MA	66	61.20	HEHE	FA	45	48.38	0.0388	✓	X
HEHE	MA	66	53.78	HEHE	MJ	28	32.70	0.0006	✓	✓
HEHE	FA	45	43.62	HEHE	FJ	28	26.36	0.0007	✓	✓
HEHE	MJ	28	31.16	HEHE	FJ	28	25.84	0.2204	X	X
TUTSI	MA	10	14.00	TUTSI	FA	15	12.33	0.6047	X	X
TUTSI	MA	10	10.15	TUTSI	MJ	8	8.69	0.5726	X	X
TUTSI	FA	15	10.87	TUTSI	FJ	4	6.75	0.2208	X	X
TUTSI	MJ	8	7.13	TUTSI	FJ	4	5.25	0.3908	X	X
HEHE	MA	66	43.24	TUTSI	MA	10	7.20	0.0000	✓	✓
HEHE	FA	45	36.97	TUTSI	FA	15	11.10	0.0000	✓	✓
HEHE	MA	66	49.39	SUKUMA	MA	49	69.59	0.0013	✓	✓
HEHE	MA	66	44.46	NYAKYUSA	MA	64	87.20	0.0000	✓	✓
TUTSI	MA	10	5.80	SUKUMA	MA	49	34.94	0.0000	✓	✓
TUTSI	MA	10	5.50	NYAKYUSA	MA	64	42.50	0.0000	✓	✓
SUKUMA	MA	49	42.36	NYAKYUSA	MA	64	68.21	0.0000	✓	✓

Table A3.4 - Interocular Distance

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	230.13	ALL	FA	130	165.24	0.0000	✓	✓
TANZANIA	MA	190	183.13	G.B.	MA	99	71.81	0.0000	✓	✓
TANZANIA	FA	60	91.73	G.B.	FA	70	43.01	0.0000	✓	✓
G.B.	MA	99	92.87	G.B.	FA	70	73.87	0.0125	✓	X
N.E.G.B.	MA	35	53.14	REST G.B.	MA	64	48.28	0.4187	X	X
N.E.G.B.	FA	19	36.11	REST G.B.	FA	51	35.27	0.8785	X	X
N.E.G.B.	MA	35	29.90	N.E.G.B.	FA	19	23.08	0.1253	X	X
REST G.B.	MA	64	63.36	REST G.B.	FA	51	51.27	0.0523	X	X
TANZANIA	MA	190	131.99	TANZANIA	FA	60	104.96	0.0114	✓	X
TANZANIA	MA	190	124.55	TANZANIA	MJ	38	79.74	0.0004	✓	✓
TANZANIA	FA	60	49.52	TANZANIA	FJ	32	40.83	0.1353	X	X
TANZANIA	MJ	38	36.41	TANZANIA	FJ	32	34.42	0.6830	X	X
HEHE	MA	66	80.17	REST.TANZ.	MA	124	103.66	0.0050	✓	✓
TUTSI	MA	10	38.55	REST.TANZ.	MA	180	98.66	0.0007	✓	✓
SUKUMA	MA	49	101.41	REST.TANZ.	MA	141	93.45	0.3817	X	X
NYAKYUSA	MA	64	117.12	REST.TANZ.	MA	126	84.52	0.0001	✓	✓
HEHE	MA	66	53.33	HEHE	FA	45	59.91	0.2884	X	X
HEHE	MA	66	49.08	HEHE	MJ	28	43.77	0.3857	X	X
HEHE	FA	45	40.87	HEHE	FJ	28	30.79	0.0473	✓	X
HEHE	MJ	28	29.43	HEHE	FJ	28	27.57	0.6684	X	X
TUTSI	MA	10	13.90	TUTSI	FA	15	12.40	0.6433	X	X
TUTSI	MA	10	8.90	TUTSI	MJ	8	10.25	0.6334	X	X
TUTSI	FA	15	10.93	TUTSI	FJ	4	6.50	0.1847	X	X
TUTSI	MJ	8	7.88	TUTSI	FJ	4	3.75	0.0599	X	X
HEHE	MA	66	41.28	TUTSI	MA	10	20.15	0.0047	✓	✓
HEHE	FA	45	35.38	TUTSI	FA	15	15.87	0.0002	✓	✓
HEHE	MA	66	52.29	SUKUMA	MA	49	65.69	0.0325	✓	X
HEHE	MA	66	52.60	NYAKYUSA	MA	64	78.80	0.0001	✓	✓
TUTSI	MA	10	13.95	SUKUMA	MA	49	33.28	0.0011	✓	✓
TUTSI	MA	10	14.65	NYAKYUSA	MA	64	41.07	0.0003	✓	✓
SUKUMA	MA	49	51.45	NYAKYUSA	MA	64	61.25	0.1143	X	X

Table A3.5 - Biocular Diameter

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	240.12	ALL	FA	130	14.305	0.0000	✓	✓
TANZANIA	MA	190	185.41	G.B.	MA	99	67.44	0.0000	✓	✓
TANZANIA	FA	60	88.30	G.B.	FA	70	45.96	0.0000	✓	✓
G.B.	MA	99	97.71	G.B.	FA	70	67.03	0.0001	✓	✓
N.E.G.B.	MA	35	54.14	REST G.B.	MA	64	47.73	0.2876	X	X
N.E.G.B.	FA	19	36.03	REST G.B.	FA	51	35.30	0.8945	X	X
N.E.G.B.	MA	35	30.93	N.E.G.B.	FA	19	21.18	0.0294	✓	✓
REST G.B.	MA	64	66.97	REST G.B.	FA	51	46.75	0.0012	✓	✓
TANZANIA	MA	190	139.62	TANZANIA	FA	60	80.79	0.0000	✓	✓
TANZANIA	MA	190	126.58	TANZANIA	MJ	38	54.11	0.0000	✓	✓
TANZANIA	FA	60	49.52	TANZANIA	FJ	32	40.83	0.1363	X	X
TANZANIA	MJ	38	36.29	TANZANIA	FJ	32	34.56	0.7232	X	X
HEHE	MA	66	62.60	REST.TANZ.	MA	124	113.01	0.0000	✓	✓
TUTSI	MA	10	12.70	REST.TANZ.	MA	180	100.10	0.0000	✓	✓
SUKUMA	MA	49	99.40	REST.TANZ.	MA	141	94.15	0.5644	X	X
NYAKYUSA	MA	64	140.81	REST.TANZ.	MA	126	72.48	0.0000	✓	✓
HEHE	MA	66	56.22	HEHE	FA	45	55.68	0.9305	X	X
HEHE	MA	66	51.45	HEHE	MJ	28	38.20	0.0309	✓	X
HEHE	FA	45	41.46	HEHE	FJ	28	29.84	0.0227	✓	X
HEHE	MJ	28	30.50	HEHE	FJ	28	26.50	0.3578	X	X
TUTSI	MA	10	14.50	TUTSI	FA	15	12.00	0.4284	X	X
TUTSI	MA	10	10.15	TUTSI	MJ	8	8.69	0.5726	X	X
TUTSI	FA	15	11.63	TUTSI	FJ	4	3.88	0.0093	✓	✓
TUTSI	MJ	8	8.19	TUTSI	FJ	4	3.13	0.0212	✓	X
HEHE	MA	66	42.69	TUTSI	MA	10	10.85	0.0000	✓	✓
HEHE	FA	45	36.44	TUTSI	FA	15	12.67	0.0000	✓	✓
HEHE	MA	66	46.12	SUKUMA	MA	49	74.00	0.0000	✓	✓
HEHE	MA	66	39.80	NYAKYUSA	MA	64	92.00	0.0000	✓	✓
TUTSI	MA	10	6.45	SUKUMA	MA	49	34.81	0.0000	✓	✓
TUTSI	MA	10	5.60	NYAKYUSA	MA	64	42.48	0.0000	✓	✓
SUKUMA	MA	49	39.59	NYAKYUSA	MA	64	70.33	0.0000	✓	✓

Table A3.6 - Mouth Width

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	273	224.52	ALL	FA	113	118.55	0.0000	✓	✓
TANZANIA	MA	174	181.75	G.B.	MA	99	58.35	0.0000	✓	✓
TANZANIA	FA	44	84.47	G.B.	FA	69	39.49	0.0000	✓	✓
G.B.	MA	99	97.38	G.B.	FA	69	66.02	0.0000	✓	✓
N.E.G.B.	MA	35	55.79	REST G.B.	MA	64	46.84	0.1374	X	X
N.E.G.B.	FA	19	44.18	REST G.B.	FA	50	31.51	0.0186	✓	X
N.E.G.B.	MA	35	29.90	N.E.G.B.	FA	19	23.08	0.1248	X	X
REST G.B.	MA	64	66.84	REST G.B.	FA	50	45.55	0.0006	✓	✓
TANZANIA	MA	174	124.83	TANZANIA	FA	44	48.88	0.0000	✓	✓
TANZANIA	MA	174	115.14	TANZANIA	MJ	31	34.84	0.0000	✓	✓
TANZANIA	FA	44	41.32	TANZANIA	FJ	29	30.45	0.0318	✓	X
TANZANIA	MJ	31	31.39	TANZANIA	FJ	29	29.55	0.6835	X	X
HEHE	MA	60	60.38	REST.TANZ.	MA	114	101.77	0.0000	✓	✓
TUTSI	MA	3	24.50	REST.TANZ.	MA	171	88.61	0.0287	✓	X
SUKUMA	MA	48	93.21	REST.TANZ.	MA	126	85.33	0.3556	X	X
NYAKYUSA	MA	63	111.90	REST.TANZ.	MA	111	73.61	0.0000	✓	✓
HEHE	MA	60	57.20	HEHE	FA	38	37.34	0.0007	✓	✓
HEHE	MA	60	50.28	HEHE	MJ	26	27.85	0.0001	✓	✓
HEHE	FA	38	38.74	HEHE	FJ	28	26.39	0.0096	✓	✓
HEHE	MJ	26	30.31	HEHE	FJ	28	24.89	0.2051	X	X
TUTSI	MA	3	7.00	TUTSI	FA	6	4.00	0.1667	X	X
TUTSI	MA	3	6.00	TUTSI	MJ	4	2.50	0.0571	X	X
TUTSI	FA	6	4.42	TUTSI	FJ	1	1.50	0.2857	X	X
TUTSI	MJ	4	3.00	TUTSI	FJ	1	3.00	1.0000	X	X
HEHE	MA	60	32.63	TUTSI	MA	3	19.50	0.2389	X	X
HEHE	FA	38	24.18	TUTSI	FA	6	11.83	0.0282	✓	X
HEHE	MA	60	45.13	SUKUMA	MA	48	66.22	0.0005	✓	✓
HEHE	MA	60	43.63	NYAKYUSA	MA	63	79.49	0.0000	✓	✓
TUTSI	MA	3	6.00	SUKUMA	MA	48	27.25	0.0098	✓	✓
TUTSI	MA	3	3.00	NYAKYUSA	MA	63	34.95	0.0003	✓	✓
SUKUMA	MA	48	48.74	NYAKYUSA	MA	63	61.53	0.0377	✓	X

Table A3.7 - Upper Lip Height

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	277	214.70	ALL	FA	113	148.42	0.0000	✓	✓
TANZANIA	MA	181	186.23	G.B.	MA	96	49.95	0.0000	✓	✓
TANZANIA	FA	54	86.02	G.B.	FA	59	30.44	0.0000	✓	✓
G.B.	MA	96	80.84	G.B.	FA	59	73.37	0.3010	X	X
N.E.G.B.	MA	34	37.37	REST G.B.	MA	62	54.60	0.0030	✓	✓
N.E.G.B.	FA	16	23.88	REST G.B.	FA	43	32.28	0.0825	X	X
N.E.G.B.	MA	34	26.28	N.E.G.B.	FA	16	23.84	0.5560	X	X
REST G.B.	MA	62	56.26	REST G.B.	FA	43	48.30	0.1794	X	X
TANZANIA	MA	181	130.01	TANZANIA	FA	54	77.74	0.0000	✓	✓
TANZANIA	MA	181	117.11	TANZANIA	MJ	33	54.79	0.0000	✓	✓
TANZANIA	FA	54	43.69	TANZANIA	FJ	31	41.79	0.7297	X	X
TANZANIA	MJ	33	31.15	TANZANIA	FJ	31	33.94	0.5445	X	X
HEHE	MA	63	65.12	REST.TANZ.	MA	118	104.82	0.0000	✓	✓
TUTSI	MA	7	83.36	REST.TANZ.	MA	174	91.31	0.6918	X	X
SUKUMA	MA	48	101.23	REST.TANZ.	MA	133	87.31	0.1121	X	X
NYAKYUSA	MA	63	109.94	REST.TANZ.	MA	118	80.89	0.0003	✓	✓
HEHE	MA	63	56.90	HEHE	FA	43	48.51	0.1638	X	X
HEHE	MA	63	50.08	HEHE	MJ	27	34.81	0.0103	✓	X
HEHE	FA	43	36.79	HEHE	FJ	28	34.79	0.6866	X	X
HEHE	MJ	27	26.69	HEHE	FJ	28	29.27	0.5444	X	X
TUTSI	MA	7	12.50	TUTSI	FA	11	7.59	0.0556	X	X
TUTSI	MA	7	7.71	TUTSI	MJ	5	4.80	0.2020	X	X
TUTSI	FA	11	7.82	TUTSI	FJ	3	6.33	0.6593	X	X
TUTSI	MJ	5	4.80	TUTSI	FJ	3	4.00	0.6468	X	X
HEHE	MA	63	35.00	TUTSI	MA	7	40.00	0.5330	X	X
HEHE	FA	43	28.79	TUTSI	FA	11	22.45	0.2293	X	X
HEHE	MA	63	46.13	SUKUMA	MA	48	68.95	0.0002	✓	✓
HEHE	MA	63	47.93	NYAKYUSA	MA	63	79.02	0.0000	✓	✓
TUTSI	MA	7	24.79	SUKUMA	MA	48	28.47	0.5776	X	X
TUTSI	MA	7	26.57	NYAKYUSA	MA	63	36.49	0.2179	X	X
SUKUMA	MA	48	52.81	NYAKYUSA	MA	63	58.43	0.3591	X	X

Table A3.8 - Lower Lip Height

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	277	213.06	ALL	FA	113	152.44	0.0000	√	√
TANZANIA	MA	181	182.13	G.B.	MA	96	57.68	0.0000	√	√
TANZANIA	FA	54	83.54	G.B.	FA	59	32.71	0.0000	√	√
G.B.	MA	96	82.04	G.B.	FA	59	71.43	0.1473	X	X
N.E.G.B.	MA	34	42.06	REST G.B.	MA	62	52.03	0.0888	X	X
N.E.G.B.	FA	16	24.13	REST G.B.	FA	43	32.19	0.1021	X	X
N.E.G.B.	MA	34	27.01	N.E.G.B.	FA	16	22.28	0.2751	X	X
REST G.B.	MA	62	56.17	REST G.B.	FA	43	48.43	0.1931	X	X
TANZANIA	MA	181	126.01	TANZANIA	FA	54	91.14	0.0009	√	√
TANZANIA	MA	181	116.28	TANZANIA	MJ	33	59.35	0.0000	√	√
TANZANIA	FA	54	45.08	TANZANIA	FJ	31	39.37	0.2995	X	X
TANZANIA	MJ	33	30.36	TANZANIA	FJ	31	34.77	0.3383	X	X
HEHE	MA	63	65.24	REST.TANZ	MA	118	104.75	0.0000	√	√
TUTSI	MA	7	69.57	REST.TANZ	MA	174	91.86	0.2668	X	X
SUKUMA	MA	48	103.85	REST.TANZ	MA	133	86.36	0.0460	√	X
NYAKYUSA	MA	63	109.35	REST.TANZ	MA	118	81.20	0.0005	√	√
HEHE	MA	63	53.17	HEHE	FA	43	53.99	0.8914	X	X
HEHE	MA	63	48.21	HEHE	MJ	27	39.19	0.1284	X	X
HEHE	FA	43	37.63	HEHE	FJ	28	33.50	0.4060	X	X
HEHE	MJ	27	26.52	HEHE	FJ	28	29.43	0.4958	X	X
TUTSI	MA	7	10.71	TUTSI	FA	11	8.73	0.4789	X	X
TUTSI	MA	7	8.64	TUTSI	MJ	5	3.50	0.0101	√	X
TUTSI	FA	11	8.09	TUTSI	FJ	3	5.33	0.3681	X	X
TUTSI	MJ	5	3.60	TUTSI	FJ	3	6.00	0.1638	X	X
HEHE	MA	63	35.06	TUTSI	MA	7	39.43	0.5855	X	X
HEHE	FA	43	27.98	TUTSI	FA	11	25.64	0.6563	X	X
HEHE	MA	63	45.60	SUKUMA	MA	48	69.95	0.0001	√	√
HEHE	MA	63	48.57	NYAKYUSA	MA	63	78.43	0.0000	√	√
TUTSI	MA	7	18.43	SUKUMA	MA	48	29.40	0.0936	X	X
TUTSI	MA	7	19.71	NYAKYUSA	MA	63	37.25	0.0290	√	X
SUKUMA	MA	48	53.81	NYAKYUSA	MA	63	57.67	0.5284	X	X

Table A3.9 - Total Height of Lips

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	277	214.90	ALL	FA	113	147.96	0.0000	✓	✓
TANZANIA	MA	181	186.38	G.B.	MA	96	49.67	0.0000	✓	✓
TANZANIA	FA	54	85.77	G.B.	FA	59	30.67	0.0000	✓	✓
G.B.	MA	96	81.84	G.B.	FA	59	71.75	0.1728	X	X
N.E.G.B.	MA	34	37.32	REST G.B.	MA	62	54.63	0.0035	✓	✓
N.E.G.B.	FA	16	22.19	REST G.B.	FA	43	32.91	0.0321	✓	X
N.E.G.B.	MA	34	26.82	N.E.G.B.	FA	16	22.69	0.3458	X	X
REST G.B.	MA	62	57.12	REST G.B.	FA	43	47.06	0.0943	X	X
TANZANIA	MA	181	129.76	TANZANIA	FA	54	78.58	0.0000	✓	✓
TANZANIA	MA	181	118.14	TANZANIA	MJ	33	49.17	0.0000	✓	✓
TANZANIA	FA	54	45.28	TANZANIA	FJ	31	39.03	0.2601	X	X
TANZANIA	MJ	33	30.95	TANZANIA	FJ	31	34.15	0.4905	X	X
HEHE	MA	63	60.36	REST.TANZ.	MA	118	107.52	0.0000	✓	✓
TUTSI	MA	7	76.36	REST.TANZ.	MA	174	91.59	0.4496	X	X
SUKUMA	MA	48	104.58	REST.TANZ.	MA	133	86.10	0.0357	✓	X
NYAKYUSA	MA	63	113.22	REST.TANZ.	MA	118	79.14	0.0000	✓	✓
HEHE	MA	63	54.85	HEHE	FA	43	51.52	0.5829	X	X
HEHE	MA	63	49.57	HEHE	MJ	27	36.00	0.0231	✓	X
HEHE	FA	43	38.13	HEHE	FJ	28	32.73	0.2802	X	X
HEHE	MJ	27	26.61	HEHE	FJ	28	29.34	0.5252	X	X
TUTSI	MA	7	12.21	TUTSI	FA	11	7.77	0.0853	X	X
TUTSI	MA	7	8.43	TUTSI	MJ	5	3.80	0.0303	✓	X
TUTSI	FA	11	8.00	TUTSI	FJ	3	5.67	0.4560	X	X
TUTSI	MJ	5	4.40	TUTSI	FJ	3	4.67	0.8801	X	X
HEHE	MA	63	34.68	TUTSI	MA	7	42.86	0.3107	X	X
HEHE	FA	43	28.63	TUTSI	FA	11	23.09	0.2961	X	X
HEHE	MA	63	43.93	SUKUMA	MA	48	71.84	0.0000	✓	✓
HEHE	MA	63	45.44	NYAKYUSA	MA	63	81.56	0.0000	✓	✓
TUTSI	MA	7	20.21	SUKUMA	MA	48	29.14	0.1724	X	X
TUTSI	MA	7	21.29	NYAKYUSA	MA	63	37.08	0.0507	X	X
SUKUMA	MA	48	52.60	NYAKYUSA	MA	63	58.59	0.3306	X	X

Table A3.10 - Right Eye Fissure Height

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	287	228.20	ALL	FA	127	160.72	0.0000	✓	✓
TANZANIA	MA	189	170.56	G.B.	MA	98	92.78	0.0000	✓	✓
TANZANIA	FA	60	79.36	G.B.	FA	67	50.25	0.0000	✓	✓
G.B.	MA	98	89.61	G.B.	FA	67	73.74	0.0287	✓	X
N.E.G.B.	MA	35	39.46	REST G.B.	MA	63	55.08	0.0079	✓	✓
N.E.G.B.	FA	19	28.71	REST G.B.	FA	48	36.09	0.1529	X	X
N.E.G.B.	MA	35	28.76	N.E.G.B.	FA	19	25.18	0.4100	X	X
REST G.B.	MA	63	62.09	REST G.B.	FA	48	48.01	0.0202	✓	X
TANZANIA	MA	189	134.08	TANZANIA	FA	68	96.41	0.0004	✓	✓
TANZANIA	MA	189	124.03	TANZANIA	MJ	38	64.13	0.0000	✓	✓
TANZANIA	FA	60	44.22	TANZANIA	FJ	31	49.45	0.3626	X	X
TANZANIA	MJ	38	29.43	TANZANIA	FJ	31	41.82	0.0096	✓	✓
HEHE	MA	65	51.95	REST.TANZ.	MA	124	117.57	0.0000	✓	✓
TUTSI	MA	10	61.95	REST.TANZ.	MA	129	96.86	0.0453	✓	X
SUKUMA	MA	49	113.89	REST.TANZ.	MA	140	88.39	0.0046	✓	✓
NYAKYUSA	MA	64	130.48	REST.TANZ.	MA	125	76.84	0.0000	✓	✓
HEHE	MA	65	52.54	HEHE	FA	45	59.78	0.2356	X	X
HEHE	MA	65	50.61	HEHE	MJ	28	38.63	0.0455	✓	X
HEHE	FA	45	34.70	HEHE	FJ	27	39.50	0.3392	X	X
HEHE	MJ	28	21.09	HEHE	FJ	27	35.17	0.0009	✓	✓
TUTSI	MA	10	12.95	TUTSI	FA	15	13.03	0.9783	X	X
TUTSI	MA	10	8.75	TUTSI	MJ	8	10.44	0.5148	X	X
TUTSI	FA	15	10.27	TUTSI	FJ	4	9.00	0.7363	X	X
TUTSI	MJ	8	7.00	TUTSI	FJ	4	5.50	0.4868	X	X
HEHE	MA	65	37.10	TUTSI	MA	10	43.85	0.3532	X	X
HEHE	FA	45	30.30	TUTSI	FA	15	31.10	0.8760	X	X
HEHE	MA	65	41.42	SUKUMA	MA	49	78.84	0.0000	✓	✓
HEHE	MA	65	38.82	NYAKYUSA	MA	64	91.59	0.0000	✓	✓
TUTSI	MA	10	15.35	SUKUMA	MA	49	32.99	0.0027	✓	✓
TUTSI	MA	10	12.62	NYAKYUSA	MA	64	41.38	0.0001	✓	✓
SUKUMA	MA	49	51.12	NYAKYUSA	MA	64	61.50	0.0896	X	X

Table A3.11 - Left Eye Fissure Height

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	287	225.62	ALL	FA	127	166.55	0.0000	√	√
TANZANIA	MA	189	170.33	G.B.	MA	98	93.23	0.0000	√	√
TANZANIA	FA	60	81.74	G.B.	FA	67	48.11	0.0000	√	√
G.B.	MA	98	89.89	G.B.	FA	67	72.93	0.0223	√	X
N.E.G.B.	MA	35	37.73	REST G.B.	MA	63	56.04	0.0019	√	√
N.E.G.B.	FA	19	32.00	REST G.B.	FA	48	34.79	0.5868	X	X
N.E.G.B.	MA	35	27.61	N.E.G.B.	FA	19	27.29	0.9398	X	X
REST G.B.	MA	63	63.40	REST G.B.	FA	48	46.28	0.0047	√	√
TANZANIA	MA	189	131.91	TANZANIA	FA	60	103.24	0.0067	√	√
TANZANIA	MA	189	121.01	TANZANIA	MJ	38	79.12	0.0003	√	√
TANZANIA	FA	60	46.47	TANZANIA	FJ	31	45.10	0.8118	X	X
TANZANIA	MJ	38	32.63	TANZANIA	FJ	31	37.90	0.2695	X	X
HEHE	MA	65	50.87	REST.TANZ.	MA	124	118.13	0.0000	√	√
TUTSI	MA	10	60.80	REST.TANZ.	MA	179	96.91	0.0405	√	X
SUKUMA	MA	49	118.52	REST.TANZ.	MA	140	86.77	0.0004	√	√
NYAKYUSA	MA	64	128.09	REST.TANZ.	MA	125	78.06	0.0000	√	√
HEHE	MA	65	49.85	HEHE	FA	45	63.67	0.0234	√	X
HEHE	MA	65	47.49	HEHE	MJ	28	45.86	0.7845	X	X
HEHE	FA	45	37.26	HEHE	FJ	27	35.24	0.6888	X	X
HEHE	MJ	28	24.50	HEHE	FJ	27	31.63	0.0929	X	X
TUTSI	MA	10	12.55	TUTSI	FA	15	13.30	0.8065	X	X
TUTSI	MA	10	8.95	TUTSI	MJ	8	10.19	0.6334	X	X
TUTSI	FA	15	9.90	TUTSI	FJ	4	10.38	0.8854	X	X
TUTSI	MJ	8	6.50	TUTSI	FJ	4	6.50	1.0000	X	X
HEHE	MA	65	37.05	TUTSI	MA	10	44.15	0.3270	X	X
HEHE	FA	45	30.87	TUTSI	FA	15	29.40	0.7754	X	X
HEHE	MA	65	40.62	SUKUMA	MA	49	79.89	0.0000	√	√
HEHE	MA	65	38.59	NYAKYUSA	MA	64	91.82	0.0000	√	√
TUTSI	MA	10	14.80	SUKUMA	MA	49	33.10	0.0019	√	√
TUTSI	MA	10	12.10	NYAKYUSA	MA	64	41.47	0.0000	√	√
SUKUMA	MA	49	54.62	NYAKYUSA	MA	64	58.82	0.4943	X	X

Table A3.12 - Right Eye Fissure Width

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	230.58	ALL	FA	130	164.25	0.0000	✓	✓
TANZANIA	MA	190	162.68	G.B.	MA	99	111.06	0.0000	✓	✓
TANZANIA	FA	60	73.63	G.B.	FA	70	58.54	0.0218	✓	X
G.B.	MA	99	92.70	G.B.	FA	70	74.11	0.0140	✓	X
N.E.G.B.	MA	35	44.84	REST G.B.	MA	64	52.82	0.1831	X	X
N.E.G.B.	FA	19	33.84	REST G.B.	FA	51	36.12	0.6729	X	X
N.E.G.B.	MA	35	28.83	N.E.G.B.	FA	19	25.05	0.3947	X	X
REST G.B.	MA	64	64.98	REST G.B.	FA	51	49.25	0.0111	✓	X
TANZANIA	MA	190	134.50	TANZANIA	FA	60	97.00	0.0004	✓	✓
TANZANIA	MA	190	123.98	TANZANIA	MJ	38	67.11	0.0000	✓	✓
TANZANIA	FA	60	48.83	TANZANIA	FJ	32	42.13	0.2493	X	X
TANZANIA	MJ	38	35.16	TANZANIA	FJ	32	35.91	0.8773	X	X
HEHE	MA	66	71.54	REST.TANZ.	MA	124	108.25	0.0000	✓	✓
TUTSI	MA	10	44.15	REST.TANZ.	MA	180	98.35	0.0023	✓	✓
SUKUMA	MA	49	89.31	REST.TANZ.	MA	141	97.65	0.3584	X	X
NYAKYUSA	MA	64	133.15	REST.TANZ.	MA	126	76.38	0.0000	✓	✓
HEHE	MA	66	55.26	HEHE	FA	45	57.09	0.7674	X	X
HEHE	MA	66	50.56	HEHE	MJ	28	40.29	0.0926	X	X
HEHE	FA	45	39.41	HEHE	FJ	28	33.13	0.2164	X	X
HEHE	MJ	28	28.50	HEHE	FJ	28	28.50	1.0000	X	X
TUTSI	MA	10	14.15	TUTSI	FA	15	12.23	0.5305	X	X
TUTSI	MA	10	11.60	TUTSI	MJ	8	6.88	0.0676	X	X
TUTSI	FA	15	10.83	TUTSI	FJ	4	6.88	0.2208	X	X
TUTSI	MJ	8	6.69	TUTSI	FJ	4	6.13	0.7950	X	X
HEHE	MA	66	40.29	TUTSI	MA	10	26.70	0.0680	X	X
HEHE	FA	45	33.21	TUTSI	FA	15	22.37	0.0365	✓	X
HEHE	MA	66	53.68	SUKUMA	MA	49	63.82	0.1050	X	X
HEHE	MA	66	44.17	NYAKYUSA	MA	64	87.50	0.0000	✓	✓
TUTSI	MA	10	18.10	SUKUMA	MA	49	32.43	0.0156	✓	X
TUTSI	MA	10	10.30	NYAKYUSA	MA	64	41.75	0.0000	✓	✓
SUKUMA	MA	49	42.55	NYAKYUSA	MA	64	68.06	0.0000	✓	✓

Table A3.13 - Left Eye Fissure Width

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	235.15	ALL	FA	130	154.08	0.0000	✓	✓
TANZANIA	MA	190	161.29	G.B.	MA	99	113.73	0.0000	✓	✓
TANZANIA	FA	60	69.44	G.B.	FA	70	62.12	0.2649	X	X
G.B.	MA	99	94.55	G.B.	FA	70	71.49	0.0023	✓	✓
N.E.G.B.	MA	35	48.11	REST G.B.	MA	64	51.03	0.6261	X	X
N.E.G.B.	FA	19	32.26	REST G.B.	FA	51	36.71	0.4079	X	X
N.E.G.B.	MA	35	30.17	N.E.G.B.	FA	19	22.58	0.4100	X	X
REST G.B.	MA	64	65.24	REST G.B.	FA	51	48.91	0.0083	✓	✓
TANZANIA	MA	190	137.77	TANZANIA	FA	60	86.66	0.0000	✓	✓
TANZANIA	MA	190	126.01	TANZANIA	MJ	38	56.96	0.0000	✓	✓
TANZANIA	FA	60	46.12	TANZANIA	FJ	32	47.22	0.8497	X	X
TANZANIA	MJ	38	31.71	TANZANIA	FJ	32	40.00	0.0875	X	X
HEHE	MA	66	70.89	REST.TANZ.	MA	124	108.60	0.0000	✓	✓
TUTSI	MA	10	31.10	REST.TANZ.	MA	180	99.08	0.0001	✓	✓
SUKUMA	MA	49	91.31	REST.TANZ.	MA	141	96.96	0.5340	X	X
NYAKYUSA	MA	64	134.38	REST.TANZ.	MA	126	75.75	0.0000	✓	✓
HEHE	MA	66	58.38	HEHE	FA	45	52.51	0.3430	X	X
HEHE	MA	66	51.84	HEHE	MJ	28	37.27	0.01722	✓	X
HEHE	FA	45	36.90	HEHE	FJ	28	37.16	0.9590	X	X
HEHE	MJ	28	25.79	HEHE	FJ	28	31.21	0.2095	X	X
TUTSI	MA	10	13.45	TUTSI	FA	15	12.70	0.8065	X	X
TUTSI	MA	10	11.75	TUTSI	MJ	8	6.69	0.0434	✓	X
TUTSI	FA	15	10.37	TUTSI	FJ	4	8.63	0.5965	X	X
TUTSI	MJ	8	5.94	TUTSI	FJ	4	7.63	0.4399	X	X
HEHE	MA	66	40.98	TUTSI	MA	10	22.10	0.0113	✓	X
HEHE	FA	45	33.18	TUTSI	FA	15	22.47	0.0386	✓	X
HEHE	MA	66	52.55	SUKUMA	MA	49	65.34	0.0408	✓	X
HEHE	MA	66	43.93	NYAKYUSA	MA	64	87.74	0.0000	✓	✓
TUTSI	MA	10	12.35	SUKUMA	MA	49	33.60	0.0003	✓	✓
TUTSI	MA	10	7.60	NYAKYUSA	MA	64	42.17	0.0000	✓	✓
SUKUMA	MA	49	41.84	NYAKYUSA	MA	64	68.61	0.0000	✓	✓

APPENDIX 3(b) - MANN-WHITNEY U TEST RESULTS USING MEASUREMENTS FROM PROFILE VIEW ONLY

Table A3.14 - Nasal Prominence

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	290	235.70	ALL	FA	128	150.15	0.0000	√	√
TANZANIA	MA	191	119.07	G.B.	MA	99	193.49	0.0000	√	√
TANZANIA	FA	58	35.77	G.B.	FA	70	88.31	0.0000	√	√
G.B.	MA	99	109.14	G.B.	FA	70	55.11	0.0000	√	√
N.E.G.B.	MA	35	46.31	REST G.B.	MA	64	52.02	0.3423	X	X
N.E.G.B.	FA	19	31.24	REST G.B.	FA	51	37.09	0.2796	X	X
N.E.G.B.	MA	35	32.41	N.E.G.B.	FA	19	18.45	0.0017	√	√
REST G.B.	MA	64	74.52	REST G.B.	FA	51	37.27	0.0000	√	√
TANZANIA	MA	191	143.07	TANZANIA	FA	58	65.49	0.0000	√	√
TANZANIA	MA	191	129.51	TANZANIA	MJ	37	37.01	0.0000	√	√
TANZANIA	FA	58	52.96	TANZANIA	FJ	33	33.77	0.0008	√	√
TANZANIA	MJ	37	35.64	TANZANIA	FJ	33	35.35	0.9528	X	X
HEHE	MA	66	61.30	REST.TANZ.	MA	125	114.32	0.0000	√	√
TUTSI	MA	11	53.95	REST.TANZ.	MA	180	98.57	0.0092	√	√
SUKUMA	MA	48	114.74	REST.TANZ.	MA	143	89.71	0.0065	√	√
NYAKYUSA	MA	65	125.32	REST.TANZ.	MA	126	80.87	0.0000	√	√
HEHE	MA	66	62.92	HEHE	FA	45	45.86	0.0059	√	√
HEHE	MA	66	55.53	HEHE	MJ	28	28.57	0.0000	√	√
HEHE	FA	45	43.57	HEHE	FJ	29	28.09	0.0024	√	√
HEHE	MJ	28	28.95	HEHE	FJ	29	29.05	0.9808	X	X
TUTSI	MA	11	14.32	TUTSI	FA	13	10.96	0.2518	X	X
TUTSI	MA	11	11.27	TUTSI	MJ	7	6.71	0.0853	X	X
TUTSI	FA	13	9.85	TUTSI	FJ	4	6.25	0.2454	X	X
TUTSI	MJ	7	6.50	TUTSI	FJ	4	5.13	0.5024	X	X
HEHE	MA	66	39.25	TUTSI	MA	11	37.50	0.8095	X	X
HEHE	FA	45	29.08	TUTSI	FA	13	30.96	0.7214	X	X
HEHE	MA	66	44.10	SUKUMA	MA	48	75.93	0.0000	√	√
HEHE	MA	66	44.39	NYAKYUSA	MA	65	87.95	0.0000	√	√
TUTSI	MA	11	14.41	SUKUMA	MA	48	33.57	0.0008	√	√
TUTSI	MA	11	13.55	NYAKYUSA	MA	65	42.72	0.0000	√	√
SUKUMA	MA	48	53.35	NYAKYUSA	MA	65	59.69	0.3076	X	X

Table A3.15 - Nasal Bridge Distance

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	217.07	ALL	FA	129	192.55	0.0543	X	X
TANZANIA	MA	190	125.58	G.B.	MA	99	182.26	0.0000	√	√
TANZANIA	FA	59	50.44	G.B.	FA	70	77.11	0.0001	√	√
G.B.	MA	99	93.25	G.B.	FA	70	73.33	0.0089	√	√
N.E.G.B.	MA	35	43.53	REST G.B.	MA	64	53.54	0.0964	X	X
N.E.G.B.	FA	19	34.00	REST G.B.	FA	51	36.06	0.7053	X	X
N.E.G.B.	MA	35	28.69	N.E.G.B.	FA	19	25.32	0.4490	X	X
REST G.B.	MA	64	65.80	REST G.B.	FA	51	48.22	0.0048	√	√
TANZANIA	MA	190	130.90	TANZANIA	FA	59	105.99	0.0200	√	X
TANZANIA	MA	190	123.26	TANZANIA	MJ	37	66.46	0.0000	√	√
TANZANIA	FA	59	51.16	TANZANIA	FJ	33	38.17	0.0246	√	X
TANZANIA	MJ	37	34.35	TANZANIA	FJ	33	36.79	0.6147	X	X
HEHE	MA	65	69.12	REST.TANZ.	MA	125	109.22	0.0000	√	√
TUTSI	MA	11	100.14	REST.TANZ.	MA	179	95.22	0.7728	X	X
SUKUMA	MA	48	107.34	REST.TANZ.	MA	142	91.50	0.0836	X	X
NYAKYUSA	MA	65	112.12	REST.TANZ.	MA	125	86.86	0.0026	√	√
HEHE	MA	65	54.00	HEHE	FA	46	58.83	0.4352	X	X
HEHE	MA	65	50.35	HEHE	MJ	28	39.21	0.0671	X	X
HEHE	FA	46	42.62	HEHE	FJ	29	30.67	0.0202	√	X
HEHE	MJ	28	27.73	HEHE	FJ	29	30.22	0.5684	X	X
TUTSI	MA	11	13.59	TUTSI	FA	13	11.58	0.4940	X	X
TUTSI	MA	11	11.36	TUTSI	MJ	7	6.57	0.0893	X	X
TUTSI	FA	13	9.23	TUTSI	FJ	4	8.25	0.7849	X	X
TUTSI	MJ	7	5.64	TUTSI	FJ	4	6.63	0.6295	X	X
HEHE	MA	65	36.47	TUTSI	MA	11	50.50	0.0507	X	X
HEHE	FA	46	29.52	TUTSI	FA	13	31.69	0.6365	X	X
HEHE	MA	65	47.33	SUKUMA	MA	48	70.09	0.0003	√	√
HEHE	MA	65	51.04	NYAKYUSA	MA	65	79.96	0.0000	√	√
TUTSI	MA	11	27.27	SUKUMA	MA	48	30.63	0.5577	X	X
TUTSI	MA	11	34.05	NYAKYUSA	MA	65	39.25	0.4679	X	X
SUKUMA	MA	48	55.10	NYAKYUSA	MA	65	58.40	0.5961	X	X

Table A3.16 - Nasal Height

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	290	233.94	ALL	FA	129	156.19	0.0000	√	√
TANZANIA	MA	191	130.85	G.B.	MA	99	173.77	0.0000	√	√
TANZANIA	FA	59	44.87	G.B.	FA	70	81.96	0.0000	√	√
G.B.	MA	99	101.42	G.B.	FA	70	61.78	0.0000	√	√
N.E.G.B.	MA	35	49.00	REST G.B.	MA	64	50.55	0.7970	X	X
N.E.G.B.	FA	19	33.92	REST G.B.	FA	51	36.09	0.6908	X	X
N.E.G.B.	MA	35	32.17	N.E.G.B.	FA	19	18.89	0.0029	√	√
REST G.B.	MA	64	69.91	REST G.B.	FA	51	43.06	0.0000	√	√
TANZANIA	MA	191	139.62	TANZANIA	FA	59	79.78	0.0000	√	√
TANZANIA	MA	191	126.74	TANZANIA	MJ	37	51.32	0.0000	√	√
TANZANIA	FA	59	53.37	TANZANIA	FJ	33	34.21	0.0009	√	√
TANZANIA	MJ	37	27.85	TANZANIA	FJ	33	32.86	0.3043	X	X
HEHE	MA	66	59.57	REST.TANZ.	MA	125	115.24	0.0000	√	√
TUTSI	MA	11	38.41	REST.TANZ.	MA	180	99.52	0.0004	√	√
SUKUMA	MA	48	111.22	REST.TANZ.	MA	143	90.89	0.0273	√	X
NYAKYUSA	MA	65	132.40	REST.TANZ.	MA	126	77.22	0.0000	√	√
HEHE	MA	66	59.98	HEHE	FA	46	51.51	0.1735	X	X
HEHE	MA	66	52.85	HEHE	MJ	28	34.89	0.0034	√	√
HEHE	FA	46	43.35	HEHE	FJ	29	29.52	0.0073	√	√
HEHE	MJ	28	31.04	HEHE	FJ	29	27.03	0.3610	X	X
TUTSI	MA	11	10.73	TUTSI	FA	13	14.00	0.2767	X	X
TUTSI	MA	11	10.27	TUTSI	MJ	7	8.29	0.4789	X	X
TUTSI	FA	13	10.35	TUTSI	FJ	4	4.63	0.0445	√	X
TUTSI	MJ	7	6.00	TUTSI	FJ	4	6.00	1.0000	X	X
HEHE	MA	66	40.81	TUTSI	MA	11	28.14	0.0808	X	X
HEHE	FA	46	29.58	TUTSI	FA	13	31.50	0.7207	X	X
HEHE	MA	66	44.19	SUKUMA	MA	48	75.80	0.0000	√	√
HEHE	MA	66	40.91	NYAKYUSA	MA	65	91.48	0.0000	√	√
TUTSI	MA	11	12.64	SUKUMA	MA	48	33.98	0.0002	√	√
TUTSI	MA	11	9.27	NYAKYUSA	MA	65	43.45	0.0000	√	√
SUKUMA	MA	48	49.56	NYAKYUSA	MA	65	62.49	0.0378	√	X

Table A3.17 - Height of Whole Upper Lip

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	230.15	ALL	FA	126	157.19	0.0000	√	√
TANZANIA	MA	191	168.27	G.B.	MA	98	99.65	0.0000	√	√
TANZANIA	FA	59	79.07	G.B.	FA	67	49.79	0.0000	√	√
G.B.	MA	98	93.86	G.B.	FA	67	67.11	0.0004	√	√
N.E.G.B.	MA	34	48.10	REST G.B.	MA	64	50.24	0.7210	X	X
N.E.G.B.	FA	19	36.37	REST G.B.	FA	48	33.06	0.5287	X	X
N.E.G.B.	MA	34	29.37	N.E.G.B.	FA	19	22.76	0.1325	X	X
REST G.B.	MA	64	64.91	REST G.B.	FA	48	45.28	0.0014	√	√
TANZANIA	MA	191	134.26	TANZANIA	FA	59	97.14	0.0005	√	√
TANZANIA	MA	191	122.71	TANZANIA	MJ	37	72.14	0.0000	√	√
TANZANIA	FA	59	48.05	TANZANIA	FJ	33	43.73	0.4541	X	X
TANZANIA	MJ	37	34.22	TANZANIA	FJ	33	36.94	0.5745	X	X
HEHE	MA	66	68.73	REST.TANZ.	MA	125	110.40	0.0000	√	√
TUTSI	MA	11	63.64	REST.TANZ.	MA	180	97.98	0.0446	√	X
SUKUMA	MA	48	107.48	REST.TANZ.	MA	143	92.15	0.0950	X	X
NYAKYUSA	MA	65	121.61	REST.TANZ.	MA	126	82.79	0.0000	√	√
HEHE	MA	66	52.92	HEHE	FA	46	61.63	0.1603	X	X
HEHE	MA	66	48.08	HEHE	MJ	28	46.13	0.7484	X	X
HEHE	FA	46	40.10	HEHE	FJ	29	34.67	0.2907	X	X
HEHE	MJ	28	28.34	HEHE	FJ	29	29.64	0.7664	X	X
TUTSI	MA	11	16.18	TUTSI	FA	13	9.38	0.0184	√	X
TUTSI	MA	11	11.68	TUTSI	MJ	7	6.07	0.0268	√	X
TUTSI	FA	13	10.15	TUTSI	FJ	4	5.25	0.1017	X	X
TUTSI	MJ	7	7.36	TUTSI	FJ	4	3.36	0.0668	X	X
HEHE	MA	66	39.06	TUTSI	MA	11	38.64	0.9532	X	X
HEHE	FA	46	34.17	TUTSI	FA	13	15.23	0.0004	√	√
HEHE	MA	66	48.22	SUKUMA	MA	48	70.26	0.0004	√	√
HEHE	MA	66	67.75	NYAKYUSA	MA	65	84.53	0.0000	√	√
TUTSI	MA	11	18.55	SUKUMA	MA	48	32.63	0.0138	√	X
TUTSI	MA	11	17.68	NYAKYUSA	MA	65	42.02	0.0007	√	√
SUKUMA	MA	48	52.79	NYAKYUSA	MA	65	60.11	0.2383	X	X

Table A3.17 - Height of Whole Upper Lip

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	230.15	ALL	FA	126	157.19	0.0000	√	√
TANZANIA	MA	191	168.27	G.B.	MA	98	99.65	0.0000	√	√
TANZANIA	FA	59	79.07	G.B.	FA	67	49.79	0.0000	√	√
G.B.	MA	98	93.86	G.B.	FA	67	67.11	0.0004	√	√
N.E.G.B.	MA	34	48.10	REST G.B.	MA	64	50.24	0.7210	X	X
N.E.G.B.	FA	19	36.37	REST G.B.	FA	48	33.06	0.5287	X	X
N.E.G.B.	MA	34	29.37	N.E.G.B.	FA	19	22.76	0.1325	X	X
REST G.B.	MA	64	64.91	REST G.B.	FA	48	45.28	0.0014	√	√
TANZANIA	MA	191	134.26	TANZANIA	FA	59	97.14	0.0005	√	√
TANZANIA	MA	191	122.71	TANZANIA	MJ	37	72.14	0.0000	√	√
TANZANIA	FA	59	48.05	TANZANIA	FJ	33	43.73	0.4541	X	X
TANZANIA	MJ	37	34.22	TANZANIA	FJ	33	36.94	0.5745	X	X
HEHE	MA	66	68.73	REST.TANZ.	MA	125	110.40	0.0000	√	√
TUTSI	MA	11	63.64	REST.TANZ.	MA	180	97.98	0.0446	√	X
SUKUMA	MA	48	107.48	REST.TANZ.	MA	143	92.15	0.0950	X	X
NYAKYUSA	MA	65	121.61	REST.TANZ.	MA	126	82.79	0.0000	√	√
HEHE	MA	66	52.92	HEHE	FA	46	61.63	0.1603	X	X
HEHE	MA	66	48.08	HEHE	MJ	28	46.13	0.7484	X	X
HEHE	FA	46	40.10	HEHE	FJ	29	34.67	0.2907	X	X
HEHE	MJ	28	28.34	HEHE	FJ	29	29.64	0.7664	X	X
TUTSI	MA	11	16.18	TUTSI	FA	13	9.38	0.0184	√	X
TUTSI	MA	11	11.68	TUTSI	MJ	7	6.07	0.0268	√	X
TUTSI	FA	13	10.15	TUTSI	FJ	4	5.25	0.1017	X	X
TUTSI	MJ	7	7.36	TUTSI	FJ	4	3.36	0.0668	X	X
HEHE	MA	66	39.06	TUTSI	MA	11	38.64	0.9532	X	X
HEHE	FA	46	34.17	TUTSI	FA	13	15.23	0.0004	√	√
HEHE	MA	66	48.22	SUKUMA	MA	48	70.26	0.0004	√	√
HEHE	MA	66	67.75	NYAKYUSA	MA	65	84.53	0.0000	√	√
TUTSI	MA	11	18.55	SUKUMA	MA	48	32.63	0.0138	√	X
TUTSI	MA	11	17.68	NYAKYUSA	MA	65	42.02	0.0007	√	√
SUKUMA	MA	48	52.79	NYAKYUSA	MA	65	60.11	0.2383	X	X

Table A3.18 - Vertical Height of Lower Face

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	247.56	ALL	FA	129	124.23	0.0000	√	√
TANZANIA	MA	191	170.09	G.B.	MA	98	98.09	0.0000	√	√
TANZANIA	FA	59	87.98	G.B.	FA	70	45.35	0.0000	√	√
G.B.	MA	98	109.20	G.B.	FA	70	49.92	0.0000	√	√
N.E.G.B.	MA	35	44.77	REST G.B.	MA	63	52.13	0.2186	X	X
N.E.G.B.	FA	19	40.32	REST G.B.	FA	51	33.71	0.2247	X	X
N.E.G.B.	MA	35	32.33	N.E.G.B.	FA	19	18.61	0.0021	√	√
REST G.B.	MA	63	77.40	REST G.B.	FA	51	32.91	0.0000	√	√
TANZANIA	MA	191	140.18	TANZANIA	FA	59	77.97	0.0000	√	√
TANZANIA	MA	191	129.59	TANZANIA	MJ	37	36.73	0.0000	√	√
TANZANIA	FA	59	52.65	TANZANIA	FJ	33	35.50	0.0031	√	√
TANZANIA	MJ	37	33.54	TANZANIA	FJ	33	37.70	0.3926	X	X
HEHE	MA	66	56.36	REST.TANZ.	MA	125	116.93	0.0000	√	√
TUTSI	MA	11	41.59	REST.TANZ.	MA	180	99.32	0.0008	√	√
SUKUMA	MA	48	114.99	REST.TANZ.	MA	143	89.63	0.0059	√	√
NYAKYUSA	MA	65	132.48	REST.TANZ.	MA	126	77.18	0.0000	√	√
HEHE	MA	66	56.80	HEHE	FA	46	56.08	0.9080	X	X
HEHE	MA	66	55.24	HEHE	MJ	28	29.25	0.0000	√	√
HEHE	FA	46	43.43	HEHE	FJ	29	29.38	0.0064	√	√
HEHE	MJ	28	26.95	HEHE	FJ	29	30.98	0.3572	X	X
TUTSI	MA	11	14.64	TUTSI	FA	13	10.69	0.1863	X	X
TUTSI	MA	11	12.23	TUTSI	MJ	7	5.21	0.0041	√	√
TUTSI	FA	13	10.96	TUTSI	FJ	4	2.63	0.0008	√	√
TUTSI	MJ	7	7.50	TUTSI	FJ	4	3.38	0.0442	√	X
HEHE	MA	66	39.86	TUTSI	MA	11	33.86	0.4099	X	X
HEHE	FA	46	32.71	TUTSI	FA	13	20.42	0.0225	√	X
HEHE	MA	66	42.80	SUKUMA	MA	48	77.71	0.0000	√	√
HEHE	MA	66	40.01	NYAKYUSA	MA	65	92.39	0.0000	√	√
TUTSI	MA	11	11.45	SUKUMA	MA	48	34.25	0.0001	√	√
TUTSI	MA	11	7.64	NYAKYUSA	MA	65	43.72	0.0000	√	√
SUKUMA	MA	48	51.09	NYAKYUSA	MA	65	61.36	0.0993	X	X

Table A3.19 - Height of Forehead Above Eyebrows

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	290	219.31	ALL	FA	218	168.10	0.0001	✓	✓
TANZANIA	MA	191	148.25	G.B.	MA	99	40.20	0.4379	X	X
TANZANIA	FA	58	59.60	G.B.	FA	60	59.40	0.9742	X	X
G.B.	MA	99	86.66	G.B.	FA	60	69.01	0.0190	✓	X
N.E.G.B.	MA	35	50.77	REST G.B.	MA	64	49.58	0.8432	X	X
N.E.G.B.	FA	18	40.78	REST G.B.	FA	42	26.10	0.0028	✓	✓
N.E.G.B.	MA	35	25.67	N.E.G.B.	FA	18	29.58	0.3820	X	X
REST G.B.	MA	64	60.89	REST G.B.	FA	42	42.24	0.0022	✓	✓
TANZANIA	MA	191	133.05	TANZANIA	FA	58	98.50	0.0014	✓	✓
TANZANIA	MA	191	118.84	TANZANIA	MJ	37	92.08	0.0238	✓	X
TANZANIA	FA	58	42.34	TANZANIA	FJ	33	52.44	0.0790	X	X
TANZANIA	MJ	37	33.05	TANZANIA	FJ	33	38.24	0.2862	X	X
HEHE	MA	66	50.00	REST.TANZ.	MA	125	120.29	0.0000	✓	✓
TUTSI	MA	11	84.41	REST.TANZ.	MA	180	96.71	0.4736	X	X
SUKUMA	MA	48	129.99	REST.TANZ.	MA	143	84.59	0.0000	✓	✓
NYAKYUSA	MA	65	118.96	REST.TANZ.	MA	129	84.15	0.0000	✓	✓
HEHE	MA	66	50.72	HEHE	FA	45	63.74	0.0362	✓	X
HEHE	MA	66	44.95	HEHE	MJ	28	53.50	0.1644	X	X
HEHE	FA	45	33.27	HEHE	FJ	29	44.07	0.0347	✓	X
HEHE	MJ	28	23.41	HEHE	FJ	29	34.40	0.0123	✓	X
TUTSI	MA	11	12.55	TUTSI	FA	13	12.46	1.0000	X	X
TUTSI	MA	11	8.00	TUTSI	MJ	7	11.86	0.1509	X	X
TUTSI	FA	13	9.12	TUTSI	FJ	4	8.63	0.8706	X	X
TUTSI	MJ	7	7.14	TUTSI	FJ	4	4.00	0.1271	X	X
HEHE	MA	66	36.43	TUTSI	MA	11	54.41	0.0135	✓	X
HEHE	FA	45	27.89	TUTSI	FA	13	35.08	0.1758	X	X
HEHE	MA	66	38.44	SUKUMA	MA	48	83.71	0.0000	✓	✓
HEHE	MA	66	42.08	NYAKYUSA	MA	65	90.29	0.0000	✓	✓
TUTSI	MA	11	17.09	SUKUMA	MA	48	32.96	0.0056	✓	✓
TUTSI	MA	11	24.82	NYAKYUSA	MA	65	40.82	0.0261	✓	X
SUKUMA	MA	48	61.75	NYAKYUSA	MA	65	53.49	0.1849	X	X

Table A3.20 - Height Of Upper Face

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	290	238.86	ALL	FA	128	142.98	0.0000	√	√
TANZANIA	MA	191	163.54	G.B.	MA	99	110.70	0.0000	√	√
TANZANIA	FA	59	72.64	G.B.	FA	69	57.54	0.0214	√	X
G.B.	MA	99	98.53	G.B.	FA	69	64.38	0.0000	√	√
N.E.G.B.	MA	35	41.29	REST G.B.	MA	64	54.77	0.0253	√	X
N.E.G.B.	FA	18	33.61	REST G.B.	FA	51	35.49	0.7320	X	X
N.E.G.B.	MA	35	29.79	N.E.G.B.	FA	18	21.58	0.0661	X	X
REST G.B.	MA	64	69.92	REST G.B.	FA	51	43.04	0.0000	√	√
TANZANIA	MA	191	139.04	TANZANIA	FA	59	81.67	0.0000	√	√
TANZANIA	MA	191	127.68	TANZANIA	MJ	37	46.46	0.0000	√	√
TANZANIA	FA	59	51.48	TANZANIA	FJ	33	37.59	0.0165	√	X
TANZANIA	MJ	37	33.39	TANZANIA	FJ	33	37.86	0.3580	X	X
HEHE	MA	66	63.25	REST.TANZ.	MA	125	113.30	0.0000	√	√
TUTSI	MA	11	26.09	REST.TANZ.	MA	180	100.27	0.0000	√	√
SUKUMA	MA	48	119.17	REST.TANZ.	MA	143	88.22	0.0009	√	√
NYAKYUSA	MA	65	125.13	REST.TANZ.	MA	126	80.97	0.0000	√	√
HEHE	MA	66	57.74	HEHE	FA	46	54.72	0.6372	X	X
HEHE	MA	66	53.70	HEHE	MJ	28	32.89	0.0007	√	√
HEHE	FA	46	42.75	HEHE	FJ	29	30.47	0.0172	√	X
HEHE	MJ	28	26.98	HEHE	FJ	29	30.95	0.3660	X	X
TUTSI	MA	11	13.23	TUTSI	FA	13	11.88	0.6490	X	X
TUTSI	MA	11	11.95	TUTSI	MJ	7	5.64	0.0114	√	X
TUTSI	FA	13	10.81	TUTSI	FJ	4	3.13	0.0034	√	√
TUTSI	MJ	7	7.43	TUTSI	FJ	4	3.50	0.0559	X	X
HEHE	MA	66	42.01	TUTSI	MA	11	20.95	0.0038	√	√
HEHE	FA	46	32.96	TUTSI	FA	13	19.54	0.0126	√	X
HEHE	MA	66	43.74	SUKUMA	MA	48	76.42	0.0000	√	√
HEHE	MA	66	43.67	NYAKYUSA	MA	65	88.67	0.0000	√	√
TUTSI	MA	11	9.95	SUKUMA	MA	48	34.59	0.0000	√	√
TUTSI	MA	11	6.59	NYAKYUSA	MA	65	43.90	0.0000	√	√
SUKUMA	MA	48	56.24	NYAKYUSA	MA	65	57.56	0.8319	X	X

Table A3.21 - Orbit - Auricle Distance

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	244.38	ALL	FA	128	129.12	0.0000	√	√
TANZANIA	MA	190	176.92	G.B.	MA	99	83.75	0.0000	√	√
TANZANIA	FA	58	84.60	G.B.	FA	70	47.84	0.0000	√	√
G.B.	MA	99	100.94	G.B.	FA	70	62.46	0.0000	√	√
N.E.G.B.	MA	35	32.61	REST G.B.	MA	64	59.51	0.0000	√	√
N.E.G.B.	FA	19	29.29	REST G.B.	FA	51	37.81	0.1178	X	X
N.E.G.B.	MA	35	30.34	N.E.G.B.	FA	19	22.26	0.0704	X	X
REST G.B.	MA	64	73.51	REST G.B.	FA	51	38.54	0.0000	√	√
TANZANIA	MA	190	141.74	TANZANIA	FA	58	68.02	0.0000	√	√
TANZANIA	MA	190	126.43	TANZANIA	MJ	37	50.19	0.0000	√	√
TANZANIA	FA	58	46.90	TANZANIA	FJ	33	44.42	0.6670	X	X
TANZANIA	MJ	37	34.78	TANZANIA	FJ	33	36.30	0.7546	X	X
HEHE	MA	65	55.10	REST.TANZ.	MA	125	116.51	0.0000	√	√
TUTSI	MA	11	34.59	REST.TANZ.	MA	179	99.24	0.0002	√	√
SUKUMA	MA	48	115.90	REST.TANZ.	MA	142	88.61	0.0029	√	√
NYAKYUSA	MA	65	132.05	REST.TANZ.	MA	125	76.50	0.0000	√	√
HEHE	MA	65	58.41	HEHE	FA	45	51.30	0.2495	X	X
HEHE	MA	65	50.92	HEHE	MJ	28	37.89	0.0324	√	X
HEHE	FA	45	38.32	HEHE	FJ	29	36.22	0.6810	X	X
HEHE	MJ	28	27.75	HEHE	FJ	29	30.21	0.5752	X	X
TUTSI	MA	11	15.41	TUTSI	FA	13	10.04	0.0629	X	X
TUTSI	MA	11	10.86	TUTSI	MJ	7	7.36	0.1791	X	X
TUTSI	FA	13	10.85	TUTSI	FJ	4	3.00	0.0034	√	√
TUTSI	MJ	7	7.43	TUTSI	FJ	4	3.50	0.0582	X	X
HEHE	MA	65	40.11	TUTSI	MA	11	29.00	0.1220	X	X
HEHE	FA	45	33.41	TUTSI	FA	13	15.96	0.0010	√	√
HEHE	MA	65	41.32	SUKUMA	MA	48	78.23	0.0000	√	√
HEHE	MA	65	39.06	NYAKYUSA	MA	65	91.94	0.0000	√	√
TUTSI	MA	11	9.77	SUKUMA	MA	48	34.64	0.0000	√	√
TUTSI	MA	11	7.36	NYAKYUSA	MA	65	43.77	0.0000	√	√
SUKUMA	MA	48	51.11	NYAKYUSA	MA	65	61.35	0.1005	X	X

Table A3.22 - Auricle-Chin Distance

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	247.32	ALL	FA	128	122.49	0.0000	√	√
TANZANIA	MA	191	177.62	G.B.	MA	98	81.42	0.0000	√	√
TANZANIA	FA	58	92.55	G.B.	FA	70	41.26	0.0000	√	√
G.B.	MA	98	110.15	G.B.	FA	70	48.59	0.0000	√	√
N.E.G.B.	MA	35	35.51	REST G.B.	MA	63	57.27	0.0003	√	√
N.E.G.B.	FA	19	30.76	REST G.B.	FA	51	37.26	0.2338	X	X
N.E.G.B.	MA	35	32.83	N.E.G.B.	FA	19	17.68	0.0007	√	√
REST G.B.	MA	63	79.06	REST G.B.	FA	51	30.86	0.0000	√	√
TANZANIA	MA	191	141.00	TANZANIA	FA	58	72.31	0.0000	√	√
TANZANIA	MA	191	129.10	TANZANIA	MJ	37	39.15	0.0000	√	√
TANZANIA	FA	58	53.87	TANZANIA	FJ	33	32.17	0.0002	√	√
TANZANIA	MJ	37	35.36	TANZANIA	FJ	33	35.65	0.9530	X	X
HEHE	MA	66	50.00	REST.TANZ.	MA	125	120.29	0.0000	√	√
TUTSI	MA	11	38.91	REST.TANZ.	MA	180	9.55	0.0004	√	√
SUKUMA	MA	48	118.91	REST.TANZ.	MA	143	99.49	0.0009	√	√
NYAKYUSA	MA	65	136.71	REST.TANZ.	MA	126	75.00	0.0000	√	√
HEHE	MA	66	55.81	HEHE	FA	45	56.28	0.9401	X	X
HEHE	MA	66	54.06	HEHE	MJ	28	32.04	0.0003	√	√
HEHE	FA	45	44.84	HEHE	FJ	29	26.10	0.0002	√	√
HEHE	MJ	28	28.50	HEHE	FJ	29	29.48	0.8230	X	X
TUTSI	MA	11	14.18	TUTSI	FA	13	11.08	0.3031	X	X
TUTSI	MA	11	12.23	TUTSI	MJ	7	5.21	0.0041	√	√
TUTSI	FA	13	10.92	TUTSI	FJ	4	2.75	0.0017	√	√
TUTSI	MJ	7	7.71	TUTSI	FJ	4	3.00	0.0230	√	X
HEHE	MA	66	39.77	TUTSI	MA	11	34.36	0.4572	X	X
HEHE	FA	45	31.92	TUTSI	FA	13	21.12	0.0418	√	X
HEHE	MA	66	39.79	SUKUMA	MA	48	81.85	0.0000	√	√
HEHE	MA	66	36.61	NYAKYUSA	MA	65	95.84	0.0000	√	√
TUTSI	MA	11	9.55	SUKUMA	MA	48	34.69	0.0000	√	√
TUTSI	MA	11	6.18	NYAKYUSA	MA	65	43.97	0.0000	√	√
SUKUMA	MA	48	50.36	NYAKYUSA	MA	65	61.90	0.0642	X	X

Table A3.24 - Columella Length

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	218.95	ALL	FA	129	188.33	0.0157	√	X
TANZANIA	MA	191	132.90	G.B.	MA	98	168.59	0.0005	√	√
TANZANIA	FA	59	53.53	G.B.	FA	70	74.67	0.0012	√	√
G.B.	MA	98	91.72	G.B.	FA	70	74.39	0.0212	√	X
N.E.G.B.	MA	34	41.91	REST G.B.	MA	64	53.53	0.0521	X	X
N.E.G.B.	FA	19	24.00	REST G.B.	FA	51	39.78	0.0033	√	√
N.E.G.B.	MA	34	30.62	N.E.G.B.	FA	19	20.53	0.0181	√	X
REST G.B.	MA	64	62.66	REST G.B.	FA	51	52.15	0.0900	X	X
TANZANIA	MA	191	131.40	TANZANIA	FA	59	106.39	0.0190	√	X
TANZANIA	MA	191	122.19	TANZANIA	MJ	37	74.82	0.0001	√	√
TANZANIA	FA	59	52.19	TANZANIA	FJ	33	36.33	0.0056	√	√
TANZANIA	MJ	37	35.85	TANZANIA	FJ	33	35.11	0.8764	X	X
HEHE	MA	66	76.70	REST.TANZ.	MA	125	106.19	0.0004	√	√
TUTSI	MA	11	61.50	REST.TANZ.	MA	180	98.11	0.0316	√	X
SUKUMA	MA	48	108.32	REST.TANZ.	MA	143	91.86	0.0719	X	X
NYAKYUSA	MA	65	112.45	REST.TANZ.	MA	126	87.51	0.0029	√	√
HEHE	MA	66	54.58	HEHE	FA	46	59.25	0.4477	X	X
HEHE	MA	66	50.14	HEHE	MJ	28	41.29	0.1451	X	X
HEHE	FA	46	43.12	HEHE	FJ	29	29.88	0.0095	√	√
HEHE	MJ	28	29.95	HEHE	FJ	29	28.09	0.6677	X	X
TUTSI	MA	11	11.95	TUTSI	FA	13	12.96	0.7330	X	X
TUTSI	MA	11	10.45	TUTSI	MJ	7	8.00	0.3749	X	X
TUTSI	FA	13	9.81	TUTSI	FJ	4	6.38	0.2454	X	X
TUTSI	MJ	7	5.57	TUTSI	FJ	4	6.75	0.4411	X	X
HEHE	MA	66	40.13	TUTSI	MA	11	32.23	0.2704	X	X
HEHE	FA	46	31.52	TUTSI	FA	13	24.62	0.1927	X	X
HEHE	MA	66	49.61	SUKUMA	MA	48	68.34	0.0026	√	√
HEHE	MA	66	53.58	NYAKYUSA	MA	65	78.62	0.0001	√	√
TUTSI	MA	11	19.14	SUKUMA	MA	48	32.49	0.0192	√	X
TUTSI	MA	11	21.86	NYAKYUSA	MA	65	41.32	0.0064	√	√
SUKUMA	MA	48	55.84	NYAKYUSA	MA	65	57.85	0.7453	X	X

Table A3.24 - Columella Length

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	289	218.95	ALL	FA	129	188.33	0.0157	✓	X
TANZANIA	MA	191	132.90	G.B.	MA	98	168.59	0.0005	✓	✓
TANZANIA	FA	59	53.53	G.B.	FA	70	74.67	0.0012	✓	✓
G.B.	MA	98	91.72	G.B.	FA	70	74.39	0.0212	✓	X
N.E.G.B.	MA	34	41.91	REST G.B.	MA	64	53.53	0.0521	X	X
N.E.G.B.	FA	19	24.00	REST G.B.	FA	51	39.78	0.0033	✓	✓
N.E.G.B.	MA	34	30.62	N.E.G.B.	FA	19	20.53	0.0181	✓	X
REST G.B.	MA	64	62.66	REST G.B.	FA	51	52.15	0.0900	X	X
TANZANIA	MA	191	131.40	TANZANIA	FA	59	106.39	0.0190	✓	X
TANZANIA	MA	191	122.19	TANZANIA	MJ	37	74.82	0.0001	✓	✓
TANZANIA	FA	59	52.19	TANZANIA	FJ	33	36.33	0.0056	✓	✓
TANZANIA	MJ	37	35.85	TANZANIA	FJ	33	35.11	0.8764	X	X
HEHE	MA	66	76.70	REST.TANZ.	MA	125	106.19	0.0004	✓	✓
TUTSI	MA	11	61.50	REST.TANZ.	MA	180	98.11	0.0316	✓	X
SUKUMA	MA	48	108.32	REST.TANZ.	MA	143	91.86	0.0719	X	X
NYAKYUSA	MA	65	112.45	REST.TANZ.	MA	126	87.51	0.0029	✓	✓
HEHE	MA	66	54.58	HEHE	FA	46	59.25	0.4477	X	X
HEHE	MA	66	50.14	HEHE	MJ	28	41.29	0.1451	X	X
HEHE	FA	46	43.12	HEHE	FJ	29	29.88	0.0095	✓	✓
HEHE	MJ	28	29.95	HEHE	FJ	29	28.09	0.6677	X	X
TUTSI	MA	11	11.95	TUTSI	FA	13	12.96	0.7330	X	X
TUTSI	MA	11	10.45	TUTSI	MJ	7	8.00	0.3749	X	X
TUTSI	FA	13	9.81	TUTSI	FJ	4	6.38	0.2454	X	X
TUTSI	MJ	7	5.57	TUTSI	FJ	4	6.75	0.4411	X	X
HEHE	MA	66	40.13	TUTSI	MA	11	32.23	0.2704	X	X
HEHE	FA	46	31.52	TUTSI	FA	13	24.62	0.1927	X	X
HEHE	MA	66	49.61	SUKUMA	MA	48	68.34	0.0026	✓	✓
HEHE	MA	66	53.58	NYAKYUSA	MA	65	78.62	0.0001	✓	✓
TUTSI	MA	11	19.14	SUKUMA	MA	48	32.49	0.0192	✓	X
TUTSI	MA	11	21.86	NYAKYUSA	MA	65	41.32	0.0064	✓	✓
SUKUMA	MA	48	55.84	NYAKYUSA	MA	65	57.85	0.7453	X	X

APPENDIX 3(c) - MANN-WHITNEY U TEST RESULTS - ANGLES (FROM PROFILE VIEW ONLY)

Table A3.25 - Nasal Angle

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	250.91	ALL	FA	153	294.19	0.0030	✓	✓
TANZANIA	MA	267	160.22	G.B.	MA	99	246.28	0.0000	✓	✓
TANZANIA	FA	82	63.69	G.B.	FA	70	91.51	0.0001	✓	✓
G.B.	MA	99	84.34	G.B.	FA	70	85.94	0.8339	X	X
N.E.G.B.	MA	35	55.23	REST.G.B.	MA	64	47.14	0.1790	X	X
N.E.G.B.	FA	19	43.11	REST.G.B.	FA	51	32.67	0.0555	X	X
N.E.G.B.	MA	35	26.29	N.E.G.B.	FA	19	29.74	0.4394	X	X
REST. G.B.	MA	64	58.41	REST.G.B.	FA	51	57.49	0.8832	X	X
TANZANIA	MA	267	168.84	TANZANIA	FA	82	195.07	0.0391	✓	X
TANZANIA	MA	267	150.26	TANZANIA	MJ	38	172.28	0.1491	X	X
TANZANIA	FA	82	57.17	TANZANIA	FJ	35	63.29	0.3707	X	X
TANZANIA	MJ	38	34.71	TANZANIA	FJ	35	39.49	0.3348	X	X
HEHE	MA	112	148.67	REST.TANZ.	MA	155	123.40	0.0082	✓	✓
TUTSI	MA	11	93.36	REST.TANZ.	MA	256	135.75	0.0741	X	X
SUKUMA	MA	48	104.14	REST.TANZ.	MA	219	140.55	0.0030	✓	✓
NYAKYUSA	MA	78	138.65	REST.TANZ.	MA	189	132.08	0.5262	X	X
KINGA	MA	18	127.00	REST.TANZ.	MA	249	134.51	0.6899	X	X
HEHE	MA	112	88.14	HEHE	FA	62	86.34	0.8207	X	X
HEHE	MA	112	72.57	HEHE	MJ	31	69.95	0.7553	X	X
HEHE	FA	62	45.47	HEHE	FJ	31	50.06	0.4376	X	X
HEHE	MJ	31	29.47	HEHE	FJ	31	33.53	0.3733	X	X
TUTSI	MA	11	9.59	TUTSI	FA	13	14.96	0.0629	X	X
TUTSI	MA	11	7.45	TUTSI	MJ	7	12.71	0.0441	✓	X
TUTSI	FA	13	7.92	TUTSI	FJ	4	12.50	0.1303	X	X
TUTSI	MJ	7	5.57	TUTSI	FJ	4	6.63	0.6319	X	X
HEHE	MA	112	64.15	TUTSI	MA	11	40.09	0.0324	✓	X
HEHE	FA	62	37.41	TUTSI	FA	13	40.81	0.6085	X	X
HEHE	MA	112	88.32	SUKUMA	MA	48	62.25	0.0011	✓	✓
HEHE	MA	112	98.42	NYAKYUSA	MA	78	91.31	0.3798	X	X
HEHE	MA	112	67.28	KINGA	MA	18	54.42	0.1778	X	X
TUTSI	MA	11	26.77	SUKUMA	MA	48	30.74	0.4883	X	X
TUTSI	MA	11	32.27	NYAKYUSA	MA	78	46.79	0.0803	X	X
TUTSI	MA	11	12.23	KINGA	MA	18	16.69	0.1733	X	X
SUKUMA	MA	48	53.45	NYAKYUSA	MA	78	69.69	0.0151	✓	X
SUKUMA	MA	48	31.20	KINGA	MA	18	39.64	0.1101	X	X
KINGA	MA	18	44.75	NYAKYUSA	MA	78	49.37	0.5250	X	X

Table A3.26 - Nasal Base Angle

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	280.86	ALL	FA	153	221.18	0.0000	✓	✓
TANZANIA	MA	267	216.91	G.B.	MA	99	93.38	0.0000	✓	✓
TANZANIA	FA	82	97.87	G.B.	FA	70	51.47	0.0000	✓	✓
G.B.	MA	99	85.04	G.B.	FA	70	84.94	0.9898	X	X
N.E.G.B.	MA	35	43.87	REST.G.B.	MA	64	53.35	0.1140	X	X
N.E.G.B.	FA	19	33.79	REST.G.B.	FA	51	36.14	0.6666	X	X
N.E.G.B.	MA	35	26.87	N.E.G.B.	FA	19	28.63	0.6957	X	X
REST. G.B	MA	64	59.00	REST.G.B.	FA	51	56.75	0.7173	X	X
TANZANIA	MA	267	183.30	TANZANIA	FA	82	147.98	0.0055	✓	✓
TANZANIA	MA	267	154.49	TANZANIA	MJ	38	142.54	0.4336	X	X
TANZANIA	FA	82	58.90	TANZANIA	FJ	35	59.09	0.9857	X	X
TANZANIA	MJ	38	40.11	TANZANIA	FJ	35	33.63	0.1907	X	X
HEHE	MA	112	116.96	REST.TANZ	MA	155	146.31	0.0021	✓	✓
TUTSI	MA	11	151.91	REST.TANZ	MA	256	135.25	0.4312	X	X
SUKUMA	MA	48	159.83	REST.TANZ	MA	219	128.34	0.0103	✓	X
NYAKYUSA	MA	78	136.87	REST.TANZ	MA	189	132.81	0.6957	X	X
KINGA	MA	18	147.75	REST.TANZ	MA	249	133.01	0.4331	X	X
HEHE	MA	112	87.37	HEHE	FA	62	87.74	0.9623	X	X
HEHE	MA	112	70.35	HEHE	MJ	31	77.95	0.3650	X	X
HEHE	FA	62	47.40	HEHE	FJ	31	46.19	0.8380	X	X
HEHE	MJ	31	34.18	HEHE	FJ	31	28.82	0.2404	X	X
TUTSI	MA	11	15.09	TUTSI	FA	13	10.31	0.1056	X	X
TUTSI	MA	11	11.23	TUTSI	MJ	7	6.79	0.0853	X	X
TUTSI	FA	13	9.62	TUTSI	FJ	4	7.00	0.4118	X	X
TUTSI	MJ	7	6.93	TUTSI	FJ	4	4.38	0.2119	X	X
HEHE	MA	112	60.58	TUTSI	MA	11	76.41	0.1592	X	X
HEHE	FA	62	38.48	TUTSI	FA	13	35.69	0.6736	X	X
HEHE	MA	112	72.66	SUKUMA	MA	48	98.79	0.0010	✓	✓
HEHE	MA	112	90.12	NYAKYUSA	MA	78	103.23	0.1052	X	X
HEHE	MA	112	63.10	KINGA	MA	18	80.44	0.0692	X	X
TUTSI	MA	11	28.73	SUKUMA	MA	48	30.29	0.7842	X	X
TUTSI	MA	11	48.68	NYAKYUSA	MA	78	44.48	0.6129	X	X
TUTSI	MA	11	16.09	KINGA	MA	18	14.33	0.6109	X	X
SUKUMA	MA	48	69.66	NYAKYUSA	MA	78	59.71	0.1368	X	X
SUKUMA	MA	48	34.59	KINGA	MA	18	30.58	0.4470	X	X
KINGA	MA	18	50.89	NYAKYUSA	MA	78	47.95	0.6858	X	X

Table A3.27 - Upper Lip Angle

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	280.58	ALL	FA	153	221.87	0.0001	✓	✓
TANZANIA	MA	267	229.53	G.B.	MA	99	59.36	0.0000	✓	✓
TANZANIA	FA	82	110.87	G.B.	FA	70	36.24	0.0000	✓	✓
G.B.	MA	99	93.70	G.B.	FA	70	72.69	0.0059	✓	✓
N.E.G.B.	MA	35	48.14	REST.G.B.	MA	64	51.02	0.6340	X	X
N.E.G.B.	FA	19	42.11	REST.G.B.	FA	51	33.04	0.0970	X	X
N.E.G.B.	MA	35	27.63	N.E.G.B.	FA	19	27.26	0.9349	X	X
REST. G.B	MA	64	66.53	REST.G.B.	FA	51	47.29	0.0021	✓	✓
TANZANIA	MA	267	174.72	TANZANIA	FA	82	175.92	0.9247	X	X
TANZANIA	MA	267	149.02	TANZANIA	MJ	38	180.99	0.0364	✓	X
TANZANIA	FA	82	55.44	TANZANIA	FJ	35	67.34	0.0819	X	X
TANZANIA	MJ	38	36.43	TANZANIA	FJ	35	37.61	0.8122	X	X
HEHE	MA	112	124.29	REST.TANZ.	MA	155	141.04	0.0806	X	X
TUTSI	MA	11	147.44	REST.TANZ.	MA	256	133.41	0.5454	X	X
SUKUMA	MA	48	134.75	REST.TANZ.	MA	219	133.84	0.9407	X	X
NYAKYUSA	MA	78	142.81	REST.TANZ.	MA	189	130.36	0.2305	X	X
KINGA	MA	18	145.78	REST.TANZ.	MA	249	133.15	0.5025	X	X
HEHE	MA	112	87.12	HEHE	FA	62	88.19	0.8924	X	X
HEHE	MA	112	68.06	HEHE	MJ	31	86.24	0.0304	✓	X
HEHE	FA	62	42.57	HEHE	FJ	31	55.85	0.0252	✓	X
HEHE	MJ	31	30.60	HEHE	FJ	31	32.40	0.6931	X	X
TUTSI	MA	11	10.64	TUTSI	FA	13	14.08	0.2518	X	X
TUTSI	MA	11	9.32	TUTSI	MJ	7	9.79	0.8601	X	X
TUTSI	FA	13	9.31	TUTSI	FJ	4	8.08	0.7034	X	X
TUTSI	MJ	7	6.43	TUTSI	FJ	4	5.25	0.5708	X	X
HEHE	MA	112	60.99	TUTSI	MA	11	72.32	0.3140	X	X
HEHE	FA	62	35.56	TUTSI	FA	13	49.62	0.0344	✓	X
HEHE	MA	112	78.38	SUKUMA	MA	48	85.45	0.3760	X	X
HEHE	MA	112	90.28	NYAKYUSA	MA	78	103.00	0.1164	X	X
HEHE	MA	112	64.15	KINGA	MA	18	73.89	0.3083	X	X
TUTSI	MA	11	31.86	SUKUMA	MA	48	29.57	0.6892	X	X
TUTSI	MA	11	46.55	NYAKYUSA	MA	78	44.78	0.8320	X	X
TUTSI	MA	11	15.05	KINGA	MA	18	14.97	0.9824	X	X
SUKUMA	MA	48	60.81	NYAKYUSA	MA	78	65.15	0.5165	X	X
SUKUMA	MA	48	32.42	KINGA	MA	18	36.39	0.4533	X	X
KINGA	MA	18	49.03	NYAKYUSA	MA	78	48.38	0.9289	X	X

Table A3.28 - Chin Angle

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	256.77	ALL	FA	153	278.14	0.1419	X	X
TANZANIA	MA	267	189.88	G.B.	MA	98	164.24	0.0393	✓	X
TANZANIA	FA	82	86.49	G.B.	FA	70	64.79	0.0024	✓	✓
G.B.	MA	98	83.68	G.B.	FA	70	85.64	0.7964	X	X
N.E.G.B.	MA	35	51.21	REST.G.B.	MA	63	48.55	0.6556	X	X
N.E.G.B.	FA	19	36.21	REST.G.B.	FA	51	35.24	0.8581	X	X
N.E.G.B.	MA	35	27.49	N.E.G.B.	FA	19	27.53	0.9927	X	X
REST. G.B.	MA	63	56.22	REST.G.B.	FA	51	59.08	0.6457	X	X
TANZANIA	MA	267	168.14	TANZANIA	FA	82	197.34	0.0217	✓	X
TANZANIA	MA	267	153.72	TANZANIA	MJ	38	147.95	0.7053	X	X
TANZANIA	FA	82	63.12	TANZANIA	FJ	35	49.36	0.0441	✓	X
TANZANIA	MJ	38	37.45	TANZANIA	FJ	35	36.51	0.8507	X	X
HEHE	MA	112	141.94	REST.TANZ.	MA	155	128.26	0.1523	X	X
TUTSI	MA	11	99.55	REST.TANZ.	MA	256	135.48	0.1300	X	X
SUKUMA	MA	48	145.72	REST.TANZ.	MA	219	131.43	0.2448	X	X
NYAKYUSA	MA	78	121.43	REST.TANZ.	MA	189	139.19	0.0869	X	X
KINGA	MA	18	128.86	REST.TANZ.	MA	249	134.37	0.7696	X	X
HEHE	MA	112	82.76	HEHE	FA	62	96.09	0.0945	X	X
HEHE	MA	112	72.63	HEHE	MJ	31	69.73	0.7294	X	X
HEHE	FA	62	51.98	HEHE	FJ	31	37.03	0.0116	✓	X
HEHE	MJ	31	33.00	HEHE	FJ	31	30.00	0.5114	X	X
TUTSI	MA	11	11.36	TUTSI	FA	13	13.46	0.4940	X	X
TUTSI	MA	11	9.18	TUTSI	MJ	7	10.00	0.7914	X	X
TUTSI	FA	13	8.65	TUTSI	FJ	4	10.13	0.6235	X	X
TUTSI	MJ	7	5.29	TUTSI	FJ	4	7.25	0.3403	X	X
HEHE	MA	112	63.67	TUTSI	MA	11	45.00	0.0968	X	X
HEHE	FA	62	39.72	TUTSI	FA	13	29.81	0.1350	X	X
HEHE	MA	112	80.02	SUKUMA	MA	48	81.63	0.8404	X	X
HEHE	MA	112	101.38	NYAKYUSA	MA	78	87.06	0.0769	X	X
HEHE	MA	112	66.38	KINGA	MA	18	60.06	0.5081	X	X
TUTSI	MA	11	21.73	SUKUMA	MA	48	31.90	0.0759	X	X
TUTSI	MA	11	37.82	NYAKYUSA	MA	78	46.01	0.3233	X	X
TUTSI	MA	11	13.00	KINGA	MA	18	16.22	0.3397	X	X
SUKUMA	MA	48	70.99	NYAKYUSA	MA	78	58.89	0.0703	X	X
SUKUMA	MA	48	34.71	KINGA	MA	18	30.28	0.4024	X	X
KINGA	MA	18	50.81	NYAKYUSA	MA	78	47.97	0.6960	X	X

Table A3.29 - Frontal Recession Angle

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	240.73	ALL	FA	150	313.02	0.0000	✓	✓
TANZANIA	MA	267	164.84	G.B.	MA	98	232.49	0.0000	✓	✓
TANZANIA	FA	82	59.09	G.B.	FA	67	94.47	0.0000	✓	✓
G.B.	MA	98	72.91	G.B.	FA	67	97.75	0.0010	✓	✓
N.E.G.B.	MA	35	52.53	REST.G.B.	MA	63	47.82	0.4309	X	X
N.E.G.B.	FA	19	27.74	REST.G.B.	FA	48	36.48	0.0972	X	X
N.E.G.B.	MA	35	26.37	N.E.G.B.	FA	19	29.58	0.4370	X	X
REST. G.B.	MA	63	46.82	REST.G.B.	FA	48	68.05	0.0006	✓	✓
TANZANIA	MA	267	168.14	TANZANIA	FA	82	197.34	0.0142	✓	X
TANZANIA	MA	267	145.51	TANZANIA	MJ	38	205.51	0.0001	✓	✓
TANZANIA	FA	82	55.01	TANZANIA	FJ	35	68.30	0.0508	X	X
TANZANIA	MJ	38	35.66	TANZANIA	FJ	35	38.46	0.5723	X	X
HEHE	MA	112	141.63	REST.TANZ.	MA	155	128.48	0.1689	X	X
TUTSI	MA	11	111.68	REST.TANZ.	MA	256	134.96	0.3257	X	X
SUKUMA	MA	48	116.43	REST.TANZ.	MA	219	137.85	0.0811	X	X
NYAKYUSA	MA	78	138.76	REST.TANZ.	MA	189	132.04	0.5171	X	X
KINGA	MA	18	126.39	REST.TANZ.	MA	249	134.55	0.6644	X	X
HEHE	MA	112	83.73	HEHE	FA	62	94.31	0.1835	X	X
HEHE	MA	112	65.71	HEHE	MJ	31	94.74	0.0005	✓	✓
HEHE	FA	62	43.72	HEHE	FJ	31	53.36	0.0965	X	X
HEHE	MJ	31	32.18	HEHE	FJ	31	30.82	0.7668	X	X
TUTSI	MA	11	11.36	TUTSI	FA	13	13.46	0.4940	X	X
TUTSI	MA	11	8.68	TUTSI	MJ	7	10.79	0.4252	X	X
TUTSI	FA	13	8.00	TUTSI	FJ	4	12.25	0.1630	X	X
TUTSI	MJ	7	4.86	TUTSI	FJ	4	8.00	0.1253	X	X
HEHE	MA	112	63.20	TUTSI	MA	11	49.77	0.2323	X	X
HEHE	FA			TUTSI	FA					
HEHE	MA	112	84.96	SUKUMA	MA	48	70.09	0.0624	X	X
HEHE	MA	112	96.42	NYAKYUSA	MA	78	94.19	0.7830	X	X
HEHE	MA	112	66.56	KINGA	MA	18	58.92	0.4235	X	X
TUTSI	MA	11	66.56	SUKUMA	MA	48	30.27	0.7999	X	X
TUTSI	MA	11	37.05	NYAKYUSA	MA	78	46.12	0.2741	X	X
TUTSI	MA	11	14.05	KINGA	MA	18	15.58	0.6423	X	X
SUKUMA	MA	78	56.82	NYAKYUSA	MA	48	67.61	0.1066	X	X
SUKUMA	MA	48	32.74	KINGA	MA	18	35.53	0.5983	X	X
KINGA	MA	18	44.86	NYAKYUSA	MA	78	49.34	0.5377	X	X

APPENDIX 3(d) - MANN-WHITNEY U TEST RESULTS - RELATIONSHIPS (USING PROFILE VIEW ONLY

Table A3.30 - Nasal Wing/Septum Relationship

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	254.67	ALL	FA	154	286.59	0.0021	✓	✓
TANZANIA	MA	267	173.20	G.B.	MA	99	211.27	0.0000	✓	✓
TANZANIA	FA	83	67.41	G.B.	FA	70	88.37	0.0003	✓	✓
G.B.	MA	99	80.68	G.B.	FA	70	91.11	0.1130	X	X
N.E.G.B.	MA	35	47.07	REST.G.B.	MA	64	51.60	0.3677	X	X
N.E.G.B.	FA	19	32.11	REST.G.B.	FA	51	36.76	0.3391	X	X
N.E.G.B.	MA	35	26.64	N.E.G.B.	FA	19	29.08	0.5070	X	X
REST. G.B	MA	64	54.79	REST.G.B.	FA	51	62.03	0.1869	X	X
TANZANIA	MA	267	173.06	TANZANIA	FA	83	183.35	0.1680	X	X
TANZANIA	MA	267	151.23	TANZANIA	MJ	38	165.41	0.1100	X	X
TANZANIA	FA	83	62.13	TANZANIA	FJ	35	53.27	0.0308	✓	X
TANZANIA	MJ	38	40.17	TANZANIA	FJ	35	33.56	0.0198	✓	X
HEHE	MA	112	143.42	REST.TANZ.	MA	155	127.19	0.0023	✓	✓
TUTSI	MA	11	143.05	REST.TANZ.	MA	256	133.61	0.4755	X	X
SUKUMA	MA	48	121.53	REST.TANZ.	MA	219	136.73	0.0263	✓	X
NYAKYUSA	MA	78	130.44	REST.TANZ.	MA	189	135.47	0.3844	X	X
KINGA	MA	18	118.50	REST.TANZ.	MA	249	135.12	0.1128	X	X
HEHE	MA	112	86.74	HEHE	FA	63	90.24	0.5345	X	X
HEHE	MA	112	70.93	HEHE	MJ	31	75.85	0.4042	X	X
HEHE	FA	63	50.64	HEHE	FJ	31	41.11	0.0149	✓	X
HEHE	MJ	31	34.98	HEHE	FJ	31	28.02	0.0130	✓	X
TUTSI	MA	11	13.68	TUTSI	FA	13	11.50	0.4583	X	X
TUTSI	MA	11	10.14	TUTSI	MJ	7	8.50	0.5360	X	X
TUTSI	FA	13	9.00	TUTSI	FJ	4	9.00	1.0000	X	X
TUTSI	MJ	7	6.00	TUTSI	FJ	4	6.00	1.0000	X	X
HEHE	MA	112	62.00	TUTSI	MA	11	61.95	0.9948	X	X
HEHE	FA	63	40.05	TUTSI	FA	13	31.00	0.0526	X	X
HEHE	MA	112	84.43	SUKUMA	MA	48	71.32	0.0061	✓	✓
HEHE	MA	112	99.30	NYAKYUSA	MA	78	90.04	0.0641	X	X
HEHE	MA	112	67.19	KINGA	MA	18	55.00	0.0467	✓	X
TUTSI	MA	11	33.77	SUKUMA	MA	48	29.14	0.0339	✓	X
TUTSI	MA	11	48.68	NYAKYUSA	MA	78	44.48	0.3339	X	X
TUTSI	MA	11	16.64	KINGA	MA	18	14.00	0.4379	X	X
SUKUMA	MA	48	60.89	NYAKYUSA	MA	78	65.11	0.1357	X	X
SUKUMA	MA	48	33.69	KINGA	MA	18	33.00	0.5403	X	X
KINGA	MA	18	45.00	NYAKYUSA	MA	78	49.31	0.1893	X	X

Table A3.31 - Frontal Protraction or Retraction

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	266.96	ALL	FA	154	256.82	0.4171	X	X
TANZANIA	MA	267	179.21	G.B.	MA	99	195.06	0.1385	X	X
TANZANIA	FA	83	72.75	G.B.	FA	70	82.04	0.1229	X	X
G.B.	MA	99	85.81	G.B.	FA	70	83.85	0.7713	X	X
N.E.G.B.	MA	35	49.56	REST.G.B.	MA	64	50.24	0.8973	X	X
N.E.G.B.	FA	19	34.11	REST.G.B.	FA	51	36.02	0.6868	X	X
N.E.G.B.	MA	35	28.09	N.E.G.B.	FA	19	26.42	0.6719	X	X
REST. G.B	MA	64	58.24	REST.G.B.	FA	51	57.70	0.9217	X	X
TANZANIA	MA	267	179.08	TANZANIA	FA	83	163.97	0.1584	X	X
TANZANIA	MA	267	156.48	TANZANIA	MJ	38	128.53	0.0298	✓	X
TANZANIA	FA	83	59.89	TANZANIA	FJ	35	58.89	0.8138	X	X
TANZANIA	MJ	38	35.71	TANZANIA	FJ	35	38.40	0.4704	X	X
HEHE	MA	112	122.91	REST.TANZ	MA	155	142.01	0.0190	✓	X
TUTSI	MA	11	140.68	REST.TANZ	MA	256	133.71	0.7303	X	X
SUKUMA	MA	48	141.19	REST.TANZ	MA	219	132.42	0.4023	X	X
NYAKYUSA	MA	78	136.48	REST.TANZ	MA	189	132.98	0.6916	X	X
KINGA	MA	18	169.00	REST.TANZ	MA	249	131.47	0.0192	✓	X
HEHE	MA	112	87.96	HEHE	FA	63	88.06	0.9877	X	X
HEHE	MA	112	73.32	HEHE	MJ	31	67.23	0.3620	X	X
HEHE	FA	63	48.33	HEHE	FJ	31	45.82	0.5991	X	X
HEHE	MJ	31	31.02	HEHE	FJ	31	31.98	0.7769	X	X
TUTSI	MA	11	12.45	TUTSI	FA	13	12.54	1.000	X	X
TUTSI	MA	11	10.59	TUTSI	MJ	7	7.79	0.2854	X	X
TUTSI	FA	13	8.92	TUTSI	FJ	4	9.25	0.9563	X	X
TUTSI	MJ	7	5.29	TUTSI	FJ	4	7.25	0.2225	X	X
HEHE	MA	112	61.27	TUTSI	MA	11	69.45	0.3734	X	X
HEHE	FA	63	37.61	TUTSI	FA	13	42.81	0.3488	X	X
HEHE	MA	112	77.21	SUKUMA	MA	48	88.17	0.0998	X	X
HEHE	MA	112	91.54	NYAKYUSA	MA	78	101.19	0.1529	X	X
HEHE	MA	112	62.39	KINGA	MA	18	84.83	0.0050	✓	✓
TUTSI	MA	11	29.91	SUKUMA	MA	48	30.02	0.9820	X	X
TUTSI	MA	11	46.23	NYAKYUSA	MA	78	44.83	0.8443	X	X
TUTSI	MA	11	13.09	KINGA	MA	18	16.17	0.3629	X	X
SUKUMA	MA	48	64.88	NYAKYUSA	MA	78	62.65	0.6995	X	X
SUKUMA	MA	48	31.63	KINGA	MA	18	38.50	0.1345	X	X
KINGA	MA	18	58.00	NYAKYUSA	MA	78	46.31	0.0633	X	X

Table A3.32 - Nasal Protraction or Retraction

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	259.76	ALL	FA	154	274.26	0.1589	X	X
TANZANIA	MA	267	171.51	G.B.	MA	99	215.83	0.0000	✓	✓
TANZANIA	FA	83	69.58	G.B.	FA	70	85.79	0.0000	✓	✓
G.B.	MA	99	85.15	G.B.	FA	70	84.79	0.8852	X	X
N.E.G.B.	MA	35	50.50	REST.G.B.	MA	74	49.73	0.6662	X	X
N.E.G.B.	FA	19	36.00	REST.G.B.	FA	51	35.31	0.7207	X	X
N.E.G.B.	MA	35	27.50	N.E.G.B.	FA	19	27.50	1.0000	X	X
REST. G.B.	MA	64	58.10	REST.G.B.	FA	51	57.87	0.9243	X	X
TANZANIA	MA	267	174.63	TANZANIA	FA	83	178.28	0.7174	X	X
TANZANIA	MA	267	153.58	TANZANIA	MJ	38	148.95	0.7083	X	X
TANZANIA	FA	83	57.77	TANZANIA	FJ	35	63.61	0.2878	X	X
TANZANIA	MJ	38	34.58	TANZANIA	FJ	35	39.63	0.2380	X	X
HEHE	MA	112	131.44	REST.TANZ.	MA	155	135.85	0.5598	X	X
TUTSI	MA	11	156.09	REST.TANZ.	MA	256	133.05	0.2203	X	X
SUKUMA	MA	48	135.25	REST.TANZ.	MA	219	133.73	0.8755	X	X
NYAKYUSA	MA	78	133.10	REST.TANZ.	MA	189	134.57	0.8774	X	X
KINGA	MA	18	137.00	REST.TANZ.	MA	249	133.78	0.8291	X	X
HEHE	MA	112	89.13	HEHE	FA	63	86.00	0.9588	X	X
HEHE	MA	112	73.22	HEHE	MJ	31	67.60	0.4243	X	X
HEHE	FA	63	45.63	HEHE	FJ	31	51.31	0.2577	X	X
HEHE	MJ	31	28.73	HEHE	FJ	31	34.27	0.1745	X	X
TUTSI	MA	11	12.41	TUTSI	FA	13	12.58	0.9547	X	X
TUTSI	MA	11	9.18	TUTSI	MJ	7	10.00	0.7914	X	X
TUTSI	FA	13	8.85	TUTSI	FJ	4	9.50	0.8706	X	X
TUTSI	MJ	7	6.00	TUTSI	FJ	4	6.00	1.0000	X	X
HEHE	MA	112	60.97	TUTSI	MA	11	72.45	0.1889	X	X
HEHE	FA	63	37.22	TUTSI	FA	13	44.69	0.1712	X	X
HEHE	MA	112	79.80	SUKUMA	MA	48	82.13	0.7095	X	X
HEHE	MA	112	95.03	NYAKYUSA	MA	78	96.17	0.8612	X	X
HEHE	MA	112	65.13	KINGA	MA	18	67.81	0.7253	X	X
TUTSI	MA	11	33.82	SUKUMA	MA	48	29.13	0.2549	X	X
TUTSI	MA	11	51.59	NYAKYUSA	MA	78	44.07	0.2596	X	X
TUTSI	MA	11	16.23	KINGA	MA	18	14.25	0.5501	X	X
SUKUMA	MA	48	64.13	NYAKYUSA	MA	78	63.13	0.8503	X	X
SUKUMA	MA	48	33.38	KINGA	MA	18	33.83	0.9111	X	X
KINGA	MA	18	49.61	NYAKYUSA	MA	78	48.24	0.8198	X	X

Table A3.33 - Labial Protraction or Retraction

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	253.62	ALL	FA	154	289.15	0.0005	✓	✓
TANZANIA	MA	267	155.85	G.B.	MA	99	258.07	0.0000	✓	✓
TANZANIA	FA	83	54.50	G.B.	FA	70	103.68	0.0000	✓	✓
G.B.	MA	99	80.44	G.B.	FA	70	91.45	0.1136	X	X
N.E.G.B.	MA	35	48.31	REST.G.B.	MA	64	50.92	0.6296	X	X
N.E.G.B.	FA	19	24.50	REST.G.B.	FA	51	39.60	0.0029	✓	✓
N.E.G.B.	MA	35	29.24	N.E.G.B.	FA	19	24.29	0.2097	X	X
REST. G.B	MA	64	52.06	REST.G.B.	FA	51	65.45	0.0198	✓	X
TANZANIA	MA	267	176.28	TANZANIA	FA	83	173.00	0.2099	X	X
TANZANIA	MA	267	153.36	TANZANIA	MJ	38	150.50	0.3958	X	X
TANZANIA	FA	83	59.50	TANZANIA	FJ	35	59.50	1.0000	X	X
TANZANIA	MJ	38	37.00	TANZANIA	FJ	35	37.00	1.0000	X	X
HEHE	MA	112	136.27	REST.TANZ.	MA	155	132.36	0.0823	X	X
TUTSI	MA	±±	131.50	REST.TANZ.	MA	256	134.11	0.6405	X	X
SUKUMA	MA	48	131.50	REST.TANZ.	MA	219	134.55	0.2915	X	X
NYAKYUSA	MA	78	133.21	REST.TANZ.	MA	189	134.33	0.6480	X	X
KINGA	MA	18	131.50	REST.TANZ.	MA	249	134.18	0.5447	X	X
HEHE	MA	112	89.13	HEHE	FA	63	86.00	0.1303	X	X
HEHE	MA	112	72.55	HEHE	MJ	31	70.00	0.2876	X	X
HEHE	FA	63	47.50	HEHE	FJ	31	47.50	1.0000	X	X
HEHE	MJ	31	31.50	HEHE	FJ	31	31.50	1.0000	X	X
TUTSI	MA	11	12.50	TUTSI	FA	13	12.50	1.0000	X	X
TUTSI	MA	11	9.50	TUTSI	MJ	7	9.50	1.0000	X	X
TUTSI	FA	13	9.00	TUTSI	FJ	4	9.00	1.0000	X	X
TUTSI	MJ	7	6.00	TUTSI	FJ	4	6.00	1.0000	X	X
HEHE	MA	112	62.60	TUTSI	MA	11	60.00	0.5257	X	X
HEHE	FA	63	38.50	TUTSI	FA	13	38.50	1.0000	X	X
HEHE	MA	112	81.36	SUKUMA	MA	48	78.50	0.1862	X	X
HEHE	MA	112	96.39	NYAKYUSA	MA	78	94.22	0.3334	X	X
HEHE	MA	112	65.82	KINGA	MA	18	63.50	0.4172	X	X
TUTSI	MA	11	30.00	SUKUMA	MA	48	30.00	1.0000	X	X
TUTSI	MA	11	44.50	NYAKYUSA	MA	78	45.07	0.7073	X	X
TUTSI	MA	11	15.00	KINGA	MA	18	15.00	1.0000	X	X
SUKUMA	MA	48	63.00	NYAKYUSA	MA	78	63.81	0.4328	X	X
SUKUMA	MA	48	33.50	KINGA	MA	18	33.50	1.0000	X	X
KINGA	MA	18	48.00	NYAKYUSA	MA	78	48.62	0.6310	X	X

Table A3.34 - Mandibular Protraction or Retraction

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	1%
ALL	MA	372	259.75	ALL	FA	154	272.56	0.2963	X	X
TANZANIA	MA	267	166.31	G.B.	MA	98	228.46	0.0000	√	√
TANZANIA	FA	83	63.20	G.B.	FA	70	89.80	0.0001	√	√
G.B.	MA	98	85.78	G.B.	FA	70	82.71	0.5463	X	X
N.E.G.B.	MA	35	50.17	REST.G.B.	MA	63	49.13	0.7960	X	X
N.E.G.B.	FA	19	35.50	REST.G.B.	FA	51	35.50	1.0000	X	X
N.E.G.B.	MA	35	27.99	N.E.G.B.	FA	19	26.61	0.6179	X	X
REST. G.B	MA	63	58.21	REST.G.B.	FA	51	56.62	0.7092	X	X
TANZANIA	MA	267	175.16	TANZANIA	FA	83	176.61	0.8963	X	X
TANZANIA	MA	267	151.36	TANZANIA	MJ	38	164.50	0.3247	X	X
TANZANIA	FA	83	55.42	TANZANIA	FJ	35	69.17	0.0248	√	X
TANZANIA	MJ	38	33.93	TANZANIA	FJ	35	40.33	0.1397	X	X
HEHE	MA	112	137.08	REST.TANZ.	MA	155	131.77	0.5279	X	X
TUTSI	MA	11	157.00	REST.TANZ.	MA	256	133.01	0.2504	X	X
SUKUMA	MA	48	124.66	REST.TANZ.	MA	219	136.05	0.2916	X	X
NYAKYUSA	MA	78	131.79	REST.TANZ.	MA	189	134.91	0.7320	X	X
KINGA	MA	18	135.28	REST.TANZ.	MA	249	133.91	0.9340	X	X
HEHE	MA	112	89.26	HEHE	FA	63	85.75	0.6222	X	X
HEHE	MA	112	71.96	HEHE	MJ	31	72.16	0.9781	X	X
HEHE	FA	63	43.30	HEHE	FJ	31	56.03	0.0181	√	X
HEHE	MJ	31	27.79	HEHE	FJ	31	35.21	0.0709	X	X
TUTSI	MA	11	13.82	TUTSI	FA	13	11.38	0.4244	X	X
TUTSI	MA	11	8.86	TUTSI	MJ	7	10.50	0.5360	X	X
TUTSI	FA	13	8.73	TUTSI	FJ	4	9.88	0.7034	X	X
TUTSI	MJ	7	6.50	TUTSI	FJ	4	5.13	0.1859	X	X
HEHE	MA	112	61.23	TUTSI	MA	11	69.82	0.3929	X	X
HEHE	FA	63	38.51	TUTSI	FA	13	38.46	0.9937	X	X
HEHE	MA	112	82.68	SUKUMA	MA	48	75.41	0.3057	X	X
HEHE	MA	112	97.04	NYAKYUSA	MA	78	93.29	0.6017	X	X
HEHE	MA	112	65.63	KINGA	MA	18	64.72	0.9162	X	X
TUTSI	MA	11	36.14	SUKUMA	MA	48	28.59	0.1200	X	X
TUTSI	MA	11	52.59	NYAKYUSA	MA	78	43.93	0.2218	X	X
TUTSI	MA	11	16.45	KINGA	MA	18	14.11	0.4923	X	X
SUKUMA	MA	48	61.38	NYAKYUSA	MA	78	64.81	0.5522	X	X
SUKUMA	MA	48	32.78	KINGA	MA	18	35.42	0.5656	X	X
KINGA	MA	18	49.53	NYAKYUSA	MA	78	48.26	0.8411	X	X

APPENDIX 3(e) - MANN-WHITNEY U TEST RESULTS - INDICES USING FRONT VIEW ONLY

Table A3.35 - Ear Protrusion Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	264.26	ALL	FA	153	258.24	0.6793	X	X
TANZANIA	MA	265	215.67	G.B.	MA	99	93.72	0.0000	√	√
TANZANIA	FA	83	93.07	G.B.	FA	69	56.57	0.0000	√	√
G.B.	MA	99	74.14	G.B.	FA	69	99.37	0.0009	√	√
N.E.G.B.	MA	35	44.80	REST.G.B.	MA	64	52.84	0.1828	X	X
N.E.G.B.	FA	19	31.74	REST.G.B.	FA	50	36.24	0.4049	X	X
N.E.G.B.	MA	35	24.91	N.E.G.B.	FA	19	32.26	0.1011	X	X
REST. G.B.	MA	64	50.19	REST.G.B.	FA	50	66.86	0.0075	√	√
TANZANIA	MA	265	173.01	TANZANIA	FA	83	179.25	0.6223	X	X
TANZANIA	MA	265	159.43	TANZANIA	MJ	39	105.41	0.0003	√	√
TANZANIA	FA	83	66.71	TANZANIA	FJ	34	40.18	0.0001	√	√
TANZANIA	MJ	39	38.36	TANZANIA	FJ	34	35.44	0.5578	X	X
HEHE	MA	111	123.69	REST.TANZ.	MA	154	139.71	0.0932	X	X
TUTSI	MA	10	84.00	REST.TANZ.	MA	255	134.92	0.0393	√	X
SUKUMA	MA	49	116.09	REST.TANZ.	MA	216	136.84	0.0872	X	X
NYAKYUSA	MA	77	160.46	REST.TANZ.	MA	188	121.75	0.0002	√	√
KINGA	MA	18	146.19	REST.TANZ.	MA	247	132.04	0.4493	X	X
HEHE	MA	111	78.46	HEHE	FA	61	101.12	0.0043	√	√
HEHE	MA	111	74.00	HEHE	MJ	31	62.53	0.1698	X	X
HEHE	FA	61	54.24	HEHE	FJ	30	29.25	0.0000	√	√
HEHE	MJ	31	33.82	HEHE	FJ	30	28.08	0.2068	X	X
TUTSI	MA	10	13.50	TUTSI	FA	15	12.67	0.8065	X	X
TUTSI	MA	10	11.70	TUTSI	MJ	8	6.75	0.0545	X	X
TUTSI	FA	15	10.93	TUTSI	FJ	4	6.50	0.1847	X	X
TUTSI	MJ	8	6.88	TUTSI	FJ	4	5.75	0.6828	X	X
HEHE	MA	111	62.53	TUTSI	MA	10	44.05	0.1106	X	X
HEHE	FA	61	43.07	TUTSI	FA	15	19.93	0.0003	√	√
HEHE	MA	111	82.00	SUKUMA	MA	49	77.09	0.5364	X	X
HEHE	MA	111	83.70	NYAKYUSA	MA	77	110.06	0.0011	√	√
HEHE	MA	111	63.45	KINGA	MA	18	74.53	0.2437	X	X
TUTSI	MA	10	24.15	SUKUMA	MA	49	31.19	0.2372	X	X
TUTSI	MA	10	22.10	NYAKYUSA	MA	77	46.84	0.0036	√	√
TUTSI	MA	10	10.20	KINGA	MA	18	16.89	0.0400	√	X
SUKUMA	MA	49	50.89	NYAKYUSA	MA	77	71.53	0.0020	√	√
SUKUMA	MA	49	31.92	KINGA	MA	18	39.67	0.1491	X	X
KINGA	MA	18	43.61	NYAKYUSA	MA	77	49.02	0.4531	X	X

Table A3.36 - Mouth Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	348	231.14	ALL	FA	128	258.52	0.0541	X	X
TANZANIA	MA	246	130.21	G.B.	MA	96	277.32	0.0000	√	√
TANZANIA	FA	68	39.22	G.B.	FA	59	92.56	0.0000	√	√
G.B.	MA	96	79.46	G.B.	FA	59	75.63	0.6058	X	X
N.E.G.B.	MA	34	63.03	REST.G.B.	MA	62	40.53	0.0002	√	√
N.E.G.B.	FA	16	40.25	REST.G.B.	FA	43	26.19	0.0051	√	√
N.E.G.B.	MA	34	25.07	N.E.G.B.	FA	16	26.41	0.7629	X	X
REST. G.B.	MA	62	53.40	REST.G.B.	FA	43	52.43	0.8731	X	X
TANZANIA	MA	246	159.69	TANZANIA	FA	68	149.57	0.4160	X	X
TANZANIA	MA	246	138.95	TANZANIA	MJ	33	147.80	0.5541	X	X
TANZANIA	FA	68	50.69	TANZANIA	FJ	31	48.48	0.7228	X	X
TANZANIA	MJ	33	35.29	TANZANIA	FJ	31	29.53	0.2164	X	X
HEHE	MA	104	140.52	REST.TANZ.	MA	142	111.03	0.0013	√	√
TUTSI	MA	3	90.00	REST.TANZ.	MA	243	123.91	0.4120	X	X
SUKUMA	MA	48	110.86	REST.TANZ.	MA	198	126.56	0.1703	X	X
NYAKYUSA	MA	73	115.15	REST.TANZ.	MA	173	127.02	0.2319	X	X
KINGA	MA	18	98.28	REST.TANZ.	MA	228	125.49	0.1183	X	X
HEHE	MA	104	85.34	HEHE	FA	55	69.91	0.0445	√	X
HEHE	MA	104	67.68	HEHE	MJ	29	64.55	0.6988	X	X
HEHE	FA	55	43.90	HEHE	FJ	30	41.35	0.6489	X	X
HEHE	MJ	29	33.28	HEHE	FJ	30	26.83	0.1497	X	X
TUTSI	MA	3	4.33	TUTSI	FA	6	5.33	0.7143	X	X
TUTSI	MA	3	3.33	TUTSI	MJ	4	4.50	0.6286	X	X
TUTSI	FA	6	3.67	TUTSI	FJ	1	6.00	0.5714	X	X
TUTSI	MJ	4	2.75	TUTSI	FJ	1	4.00	0.800	X	X
HEHE	MA	104	54.60	TUTSI	MA	3	3.33	0.2593	X	X
HEHE	FA	55	31.20	TUTSI	FA	6	29.17	0.8042	X	X
HEHE	MA	104	82.33	SUKUMA	MA	48	63.88	0.0163	√	X
HEHE	MA	104	96.61	NYAKYUSA	MA	73	78.16	0.0183	√	X
HEHE	MA	104	64.49	KINGA	MA	18	44.22	0.0248	√	X
TUTSI	MA	3	22.67	SUKUMA	MA	48	26.21	0.7194	X	X
TUTSI	MA	3	29.67	NYAKYUSA	MA	73	38.86	0.5077	X	X
TUTSI	MA	3	10.33	KINGA	MA	18	11.11	0.8872	X	X
SUKUMA	MA	48	59.78	NYAKYUSA	MA	73	61.80	0.7566	X	X
SUKUMA	MA	48	34.50	KINGA	MA	18	30.83	0.4895	X	X
KINGA	MA	18	40.61	NYAKYUSA	MA	73	47.33	0.3338	X	X

Table A3.37 - Lip Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	356	260.69	ALL	FA	138	213.48	0.0009	√	√
TANZANIA	MA	254	205.66	G.B.	MA	96	95.69	0.0000	√	√
TANZANIA	FA	78	88.07	G.B.	FA	59	43.79	0.0000	√	√
G.B.	MA	96	78.14	G.B.	FA	59	77.77	0.9601	X	X
N.E.G.B.	MA	34	43.91	REST.G.B.	MA	62	51.02	0.2291	X	X
N.E.G.B.	FA	16	27.00	REST.G.B.	FA	43	31.12	0.4110	X	X
N.E.G.B.	MA	34	25.50	N.E.G.B.	FA	16	25.50	1.0000	X	X
REST. G.B.	MA	62	53.75	REST.G.B.	FA	43	51.92	0.7604	X	X
TANZANIA	MA	254	171.95	TANZANIA	FA	78	148.76	0.0596	X	X
TANZANIA	MA	254	146.34	TANZANIA	MJ	35	133.26	0.4574	X	X
TANZANIA	FA	78	56.73	TANZANIA	FJ	33	54.27	0.7105	X	X
TANZANIA	MJ	35	36.31	TANZANIA	FJ	33	32.58	0.4288	X	X
HEHE	MA	107	129.54	REST.TANZ.	MA	147	126.01	0.7027	X	X
TUTSI	MA	7	137.29	REST.TANZ.	MA	247	127.22	0.7182	X	X
SUKUMA	MA	48	116.57	REST.TANZ.	MA	206	120.05	0.2479	X	X
NYAKYUSA	MA	74	130.22	REST.TANZ.	MA	180	126.38	0.7021	X	X
KINGA	MA	18	129.50	REST.TANZ.	MA	236	127.35	0.9037	X	X
HEHE	MA	107	88.04	HEHE	FA	60	76.79	0.1466	X	X
HEHE	MA	107	70.86	HEHE	MJ	30	62.37	0.2974	X	X
HEHE	FA	60	46.19	HEHE	FJ	30	44.12	0.7195	X	X
HEHE	MJ	30	31.48	HEHE	FJ	30	29.52	0.6582	X	X
TUTSI	MA	7	11.93	TUTSI	FA	11	7.95	0.1259	X	X
TUTSI	MA	7	6.43	TUTSI	MJ	5	6.60	1.0000	X	X
TUTSI	FA	11	7.55	TUTSI	FJ	3	7.33	1.0000	X	X
TUTSI	MJ	5	5.20	TUTSI	FJ	3	3.33	0.3929	X	X
HEHE	MA	107	57.29	TUTSI	MA	7	60.64	0.7941	X	X
HEHE	FA	60	37.70	TUTSI	FA	11	26.73	0.1030	X	X
HEHE	MA	107	80.33	SUKUMA	MA	48	72.81	0.3328	X	X
HEHE	MA	107	90.78	NYAKYUSA	MA	74	91.32	0.9455	X	X
HEHE	MA	107	63.14	KINGA	MA	18	62.17	0.9150	X	X
TUTSI	MA	7	31.50	SUKUMA	MA	48	27.49	0.5441	X	X
TUTSI	MA	7	43.14	NYAKYUSA	MA	74	40.80	0.7986	X	X
TUTSI	MA	7	14.00	KINGA	MA	18	12.61	0.7007	X	X
SUKUMA	MA	48	57.54	NYAKYUSA	MA	74	64.07	0.3149	X	X
SUKUMA	MA	48	32.23	KINGA	MA	18	36.89	0.3707	X	X
KINGA	MA	18	46.33	NYAKYUSA	MA	74	46.54	0.9758	X	X

Table A3.38 - Eye Fissure Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	368	251.90	ALL	FA	152	281.32	0.0422	√	X
TANZANIA	MA	263	161.48	G.B.	MA	98	233.39	0.0000	√	√
TANZANIA	FA	84	58.78	G.B.	FA	67	97.61	0.0000	√	√
G.B.	MA	98	79.81	G.B.	FA	67	87.67	0.2987	X	X
N.E.G.B.	MA	35	58.49	REST.G.B.	MA	63	44.51	0.0197	√	X
N.E.G.B.	FA	19	36.03	REST.G.B.	FA	48	33.20	0.5918	X	X
N.E.G.B.	MA	35	27.66	N.E.G.B.	FA	19	27.21	0.9206	X	X
REST. G.B	MA	63	51.78	REST.G.B.	FA	48	61.54	0.1131	X	X
TANZANIA	MA	263	174.79	TANZANIA	FA	84	171.52	0.7049	X	X
TANZANIA	MA	263	148.78	TANZANIA	MJ	39	169.86	0.1592	X	X
TANZANIA	FA	84	60.12	TANZANIA	FJ	33	56.15	0.5690	X	X
TANZANIA	MJ	39	40.09	TANZANIA	FJ	33	32.26	0.1135	X	X
HEHE	MA	110	171.47	REST.TANZ.	MA	153	103.62	0.0000	√	√
TUTSI	MA	10	113.30	REST.TANZ.	MA	253	132.74	0.4277	X	X
SUKUMA	MA	49	80.27	REST.TANZ.	MA	214	143.85	0.0000	√	√
NYAKYUSA	MA	77	116.68	REST.TANZ.	MA	186	138.34	0.0354	√	X
KINGA	MA	17	106.15	REST.TANZ.	MA	246	133.76	0.1471	X	X
HEHE	MA	110	94.40	HEHE	FA	62	72.48	0.0056	√	√
HEHE	MA	110	69.99	HEHE	MJ	31	74.58	0.5802	X	X
HEHE	FA	62	47.15	HEHE	FJ	29	43.55	0.5453	X	X
HEHE	MJ	31	35.97	HEHE	FJ	29	34.66	0.0121	√	X
TUTSI	MA	10	13.50	TUTSI	FA	15	12.67	0.8065	X	X
TUTSI	MA	10	11.70	TUTSI	MJ	8	6.75	0.0506	X	X
TUTSI	FA	15	10.33	TUTSI	FJ	4	8.75	0.6646	X	X
TUTSI	MJ	8	6.19	TUTSI	FJ	4	7.13	0.6828	X	X
HEHE	MA	110	62.53	TUTSI	MA	10	37.65	0.0200	√	X
HEHE	FA	62	40.52	TUTSI	FA	15	32.70	0.2241	X	X
HEHE	MA	110	95.86	SUKUMA	MA	49	44.39	0.0000	√	√
HEHE	MA	110	111.02	NYAKYUSA	MA	77	69.69	0.0000	√	√
HEHE	MA	110	68.51	KINGA	MA	17	34.82	0.0004	√	√
TUTSI	MA	10	36.70	SUKUMA	MA	49	28.63	0.1758	X	X
TUTSI	MA	10	41.70	NYAKYUSA	MA	77	44.30	0.7594	X	X
TUTSI	MA	10	13.75	KINGA	MA	17	14.15	0.9010	X	X
SUKUMA	MA	49	51.03	NYAKYUSA	MA	77	71.44	0.0022	√	√
SUKUMA	MA	49	31.21	KINGA	MA	17	40.09	0.1004	X	X
KINGA	MA	17	44.09	NYAKYUSA	MA	77	48.25	0.5684	X	X

Table A3.39 - Ocular Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	260.11	ALL	FA	155	271.62	0.4284	X	X
TANZANIA	MA	265	163.80	G.B.	MA	99	232.57	0.0000	√	√
TANZANIA	FA	84	59.30	G.B.	FA	70	99.34	0.0000	√	√
G.B.	MA	99	82.42	G.B.	FA	70	88.65	0.4148	X	X
N.E.G.B.	MA	35	48.21	REST.G.B.	MA	64	50.98	0.6473	X	X
N.E.G.B.	FA	19	34.34	REST.G.B.	FA	51	35.93	0.7713	X	X
N.E.G.B.	MA	35	26.81	N.E.G.B.	FA	19	28.76	0.6637	X	X
REST. G.B	MA	64	56.16	REST.G.B.	FA	51	60.31	0.5064	X	X
TANZANIA	MA	265	178.76	TANZANIA	FA	84	163.13	0.2159	X	X
TANZANIA	MA	265	155.41	TANZANIA	MJ	39	132.74	0.1327	X	X
TANZANIA	FA	84	58.14	TANZANIA	FJ	34	62.85	0.4981	X	X
TANZANIA	MJ	39	34.55	TANZANIA	FJ	34	39.81	0.2909	X	X
HEHE	MA	111	132.40	REST.TANZ.	MA	154	133.43	0.9140	X	X
TUTSI	MA	10	142.45	REST.TANZ.	MA	255	132.63	0.6910	X	X
SUKUMA	MA	49	128.53	REST.TANZ.	MA	216	134.01	0.6511	X	X
NYAKYUSA	MA	77	135.08	REST.TANZ.	MA	188	132.15	0.7776	X	X
KINGA	MA	18	134.72	REST.TANZ.	MA	247	132.87	0.9213	X	X
HEHE	MA	111	89.48	HEHE	FA	62	82.56	0.3831	X	X
HEHE	MA	111	73.57	HEHE	MJ	31	64.10	0.2570	X	X
HEHE	FA	62	45.50	HEHE	FJ	30	48.57	0.6055	X	X
HEHE	MJ	31	29.13	HEHE	FJ	30	32.93	0.4027	X	X
TUTSI	MA	10	14.00	TUTSI	FA	15	12.33	0.5788	X	X
TUTSI	MA	10	11.05	TUTSI	MJ	8	7.56	0.1728	X	X
TUTSI	FA	15	9.80	TUTSI	FJ	4	10.75	0.8096	X	X
TUTSI	MJ	8	5.50	TUTSI	FJ	4	8.50	0.2141	X	X
HEHE	MA	111	60.73	TUTSI	MA	10	64.00	0.7776	X	X
HEHE	FA	62	38.63	TUTSI	FA	15	40.53	0.7673	X	X
HEHE	MA	111	81.26	SUKUMA	MA	49	78.78	0.7544	X	X
HEHE	MA	111	93.54	NYAKYUSA	MA	77	95.83	0.7716	X	X
HEHE	MA	111	64.87	KINGA	MA	18	65.81	0.9215	X	X
TUTSI	MA	10	33.10	SUKUMA	MA	49	29.37	0.5310	X	X
TUTSI	MA	10	47.30	NYAKYUSA	MA	77	43.57	0.6605	X	X
TUTSI	MA	10	14.55	KINGA	MA	18	14.47	0.9812	X	X
SUKUMA	MA	49	61.92	NYAKYUSA	MA	77	64.51	0.6981	X	X
SUKUMA	MA	49	33.47	KINGA	MA	18	25.44	0.7129	X	X
KINGA	MA	18	47.50	NYAKYUSA	MA	77	48.12	0.9319	X	X

Table A3.40 - Mouth Width Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	353	223.28	ALL	FA	138	304.12	0.0000	✓	✓
TANZANIA	MA	248	137.13	G.B.	MA	99	266.36	0.0000	✓	✓
TANZANIA	FA	68	48.82	G.B.	FA	69	88.88	0.0000	✓	✓
G.B.	MA	99	82.82	G.B.	FA	69	86.91	0.5925	X	X
N.E.G.B.	MA	35	46.13	REST.G.B.	MA	64	52.12	0.3213	X	X
N.E.G.B.	FA	19	26.71	REST.G.B.	FA	50	38.15	0.0344	✓	X
N.E.G.B.	MA	35	28.16	N.E.G.B.	FA	19	26.29	0.6769	X	X
REST. G.B.	MA	64	55.43	REST.G.B.	FA	50	60.15	0.4493	X	X
TANZANIA	MA	248	148.89	TANZANIA	FA	68	193.56	0.0004	✓	✓
TANZANIA	MA	248	185.90	TANZANIA	MJ	33	170.33	0.0039	✓	✓
TANZANIA	FA	68	50.21	TANZANIA	FJ	31	49.55	0.9159	X	X
TANZANIA	MJ	33	32.70	TANZANIA	FJ	31	32.19	0.8984	X	X
HEHE	MA	105	128.95	REST.TANZ.	MA	143	121.23	0.4023	X	X
TUTSI	MA	3	119.00	REST.TANZ.	MA	245	124.57	0.8937	X	X
SUKUMA	MA	48	98.51	REST.TANZ.	MA	200	130.74	0.0052	✓	✓
NYAKYUSA	MA	74	125.61	REST.TANZ.	MA	174	124.03	0.8732	X	X
KINGA	MA	18	164.17	REST.TANZ.	MA	230	121.40	0.0148	✓	X
HEHE	MA	105	74.83	HEHE	FA	55	91.33	0.0324	✓	X
HEHE	MA	105	64.41	HEHE	MJ	29	78.67	0.0800	X	X
HEHE	FA	55	42.72	HEHE	FJ	30	43.52	0.8867	X	X
HEHE	MJ	29	20.59	HEHE	FJ	30	30.40	0.8556	X	X
TUTSI	MA	3	3.67	TUTSI	FA	6	5.67	0.3810	X	X
TUTSI	MA	3	2.00	TUTSI	MJ	4	5.50	0.0571	X	X
TUTSI	FA	6	4.00	TUTSI	FJ	1	4.00	1.0000	X	X
TUTSI	MJ	6	3.00	TUTSI	FJ	4	3.00	1.0000	X	X
HEHE	MA	105	54.62	TUTSI	MA	3	50.33	0.8327	X	X
HEHE	FA	55	31.00	TUTSI	FA	6	31.00	1.0000	X	X
HEHE	MA	105	82.75	SUKUMA	MA	48	64.42	0.0176	✓	X
HEHE	MA	105	91.01	NYAKYUSA	MA	74	88.57	0.7562	X	X
HEHE	MA	105	59.57	KINGA	MA	18	76.17	0.0680	X	X
TUTSI	MA	3	32.33	SUKUMA	MA	48	25.60	0.4785	X	X
TUTSI	MA	3	35.67	NYAKYUSA	MA	74	39.14	0.8138	X	X
TUTSI	MA	3	6.67	KINGA	MA	18	11.72	0.2211	X	X
SUKUMA	MA	48	53.38	NYAKYUSA	MA	74	66.77	0.0410	✓	X
SUKUMA	MA	48	28.61	KINGA	MA	18	46.53	0.0007	✓	✓
KINGA	MA	18	58.25	NYAKYUSA	MA	74	43.64	0.0374	✓	X

Table A3.41 - Nasal Breadth Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	238.82	ALL	FA	155	322.57	0.0000	√	√
TANZANIA	MA	265	135.12	G.B.	MA	99	309.33	0.0000	√	√
TANZANIA	FA	84	45.20	G.B.	FA	70	116.25	0.0000	√	√
G.B.	MA	99	81.70	G.B.	FA	70	89.66	0.2974	X	X
N.E.G.B.	MA	35	47.73	REST.G.B.	MA	63	51.24	0.5606	X	X
N.E.G.B.	FA	19	38.55	REST.G.B.	FA	51	34.36	0.4436	X	X
N.E.G.B.	MA	35	25.27	N.E.G.B.	FA	19	31.61	0.1576	X	X
REST. G.B	MA	64	57.20	REST.G.B.	FA	51	59.01	0.7719	X	X
TANZANIA	MA	265	163.34	TANZANIA	FA	84	211.74	0.0001	√	√
TANZANIA	MA	265	145.54	TANZANIA	MJ	39	199.79	0.0003	√	√
TANZANIA	FA	84	56.85	TANZANIA	FJ	34	66.06	0.1841	X	X
TANZANIA	MJ	39	36.05	TANZANIA	FJ	34	38.09	0.6824	X	X
HEHE	MA	111	123.78	REST.TANZ.	MA	154	139.65	0.0964	X	X
TUTSI	MA	10	210.85	REST.TANZ.	MA	255	129.95	0.0011	√	√
SUKUMA	MA	49	143.21	REST.TANZ.	MA	216	130.68	0.3014	X	X
NYAKYUSA	MA	77	135.86	REST.TANZ.	MA	188	131.83	0.6977	X	X
KINGA	MA	18	106.58	REST.TANZ.	MA	247	134.93	0.1298	X	X
HEHE	MA	111	78.84	HEHE	FA	62	101.61	0.0041	√	√
HEHE	MA	111	65.52	HEHE	MJ	31	92.90	0.0011	√	√
HEHE	FA	62	42.97	HEHE	FJ	30	53.80	0.0681	X	X
HEHE	MJ	31	29.92	HEHE	FJ	30	32.12	0.6289	X	X
TUTSI	MA	10	12.20	TUTSI	FA	15	13.53	0.6353	X	X
TUTSI	MA	10	9.50	TUTSI	MJ	8	9.50	1.0000	X	X
TUTSI	FA	15	10.27	TUTSI	FJ	4	9.00	0.7363	X	X
TUTSI	MJ	8	6.38	TUTSI	FJ	4	6.75	0.9333	X	X
HEHE	MA	111	57.77	TUTSI	MA	10	96.80	0.0000	√	√
HEHE	FA	62	35.11	TUTSI	FA	15	55.07	0.0019	√	√
HEHE	MA	111	76.67	SUKUMA	MA	49	89.18	0.1152	X	X
HEHE	MA	111	90.97	NYAKYUSA	MA	77	99.59	0.2853	X	X
HEHE	MA	111	66.37	KINGA	MA	18	56.56	0.3015	X	X
TUTSI	MA	10	43.30	SUKUMA	MA	49	27.29	0.0072	√	√
TUTSI	MA	10	65.80	NYAKYUSA	MA	77	41.17	0.0037	√	√
TUTSI	MA	10	21.45	KINGA	MA	18	10.64	0.0004	√	√
SUKUMA	MA	49	65.18	NYAKYUSA	MA	77	62.43	0.6797	X	X
SUKUMA	MA	49	36.56	KINGA	MA	18	27.03	0.0758	X	X
KINGA	MA	18	40.86	NYAKYUSA	MA	77	49.67	0.2223	X	X

Table A3.42 - Interoccular Width Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	1%
ALL	MA	371	260.49	ALL	FA	155	270.70	0.4825	X	X
TANZANIA	MA	265	151.06	G.B.	MA	99	266.65	0.0000	√	√
TANZANIA	FA	84	52.45	G.B.	FA	70	107.56	0.0000	√	√
G.B.	MA	99	85.98	G.B.	FA	70	83.61	0.7557	X	X
N.E.G.B.	MA	35	45.96	REST.G.B.	MA	64	52.21	0.3003	X	X
N.E.G.B.	FA	19	36.97	REST.G.B.	FA	51	34.94	0.7115	X	X
N.E.G.B.	MA	35	26.74	N.E.G.B.	FA	19	28.89	0.6311	X	X
REST. G.B	MA	64	59.95	REST.G.B.	FA	51	55.55	0.4816	X	X
TANZANIA	MA	265	180.48	TANZANIA	FA	84	157.71	0.0715	X	X
TANZANIA	MA	265	157.54	TANZANIA	MJ	39	118.23	0.0091	√	√
TANZANIA	FA	84	59.56	TANZANIA	FJ	34	59.35	0.9763	X	X
TANZANIA	MJ	39	35.01	TANZANIA	FJ	34	39.28	0.3914	X	X
HEHE	MA	111	127.90	REST.TANZ.	MA	154	136.68	0.3578	X	X
TUTSI	MA	10	126.25	REST.TANZ.	MA	255	133.26	0.7765	X	X
SUKUMA	MA	49	133.19	REST.TANZ.	MA	216	132.96	0.9844	X	X
NYAKYUSA	MA	77	139.47	REST.TANZ.	MA	188	130.35	0.3793	X	X
KINGA	MA	18	140.00	REST.TANZ.	MA	247	132.49	0.6881	X	X
HEHE	MA	111	90.18	HEHE	FA	62	81.31	0.2644	X	X
HEHE	MA	111	74.38	HEHE	MJ	31	61.18	0.1140	X	X
HEHE	FA	62	46.46	HEHE	FJ	30	46.58	0.9834	X	X
HEHE	MJ	31	31.35	HEHE	FJ	30	30.63	0.7346	X	X
TUTSI	MA	10	13.00	TUTSI	FA	15	13.00	1.0000	X	X
TUTSI	MA	10	11.10	TUTSI	MJ	8	7.50	0.1728	X	X
TUTSI	FA	15	10.03	TUTSI	FJ	4	9.88	0.9613	X	X
TUTSI	MJ	8	5.38	TUTSI	FJ	4	8.75	0.1535	X	X
HEHE	MA	111	61.05	TUTSI	MA	10	60.40	0.9550	X	X
HEHE	FA	62	38.29	TUTSI	FA	15	41.93	0.5714	X	X
HEHE	MA	111	79.69	SUKUMA	MA	49	82.33	0.7404	X	X
HEHE	MA	111	90.95	NYAKYUSA	MA	77	99.62	0.2823	X	X
HEHE	MA	111	64.21	KINGA	MA	18	69.89	0.5497	X	X
TUTSI	MA	10	28.75	SUKUMA	MA	49	30.26	0.8006	X	X
TUTSI	MA	10	40.00	NYAKYUSA	MA	77	44.52	0.5945	X	X
TUTSI	MA	10	13.60	KINGA	MA	18	15.00	0.6888	X	X
SUKUMA	MA	49	62.04	NYAKYUSA	MA	77	64.43	0.7205	X	X
SUKUMA	MA	49	33.57	KINGA	MA	18	35.17	0.7665	X	X
KINGA	MA	18	48.44	NYAKYUSA	MA	77	47.90	0.9394	X	X

Table A3.43 - Biocular Width Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	257.68	ALL	FA	155	277.44	0.1741	X	X
TANZANIA	MA	265	148.85	G.B.	MA	99	272.56	0.0000	√	√
TANZANIA	FA	84	55.87	G.B.	FA	70	103.46	0.0000	√	√
G.B.	MA	99	90.75	G.B.	FA	70	76.87	0.0693	X	X
N.E.G.B.	MA	35	49.37	REST.G.B.	MA	64	50.34	0.8721	X	X
N.E.G.B.	FA	19	37.97	REST.G.B.	FA	51	34.58	0.5347	X	X
N.E.G.B.	MA	35	28.04	N.E.G.B.	FA	19	26.50	0.7307	X	X
REST. G.B	MA	64	63.30	REST.G.B.	FA	51	51.34	0.0559	X	X
TANZANIA	MA	265	176.67	TANZANIA	FA	84	169.74	0.5837	X	X
TANZANIA	MA	265	157.69	TANZANIA	MJ	39	117.24	0.0073	√	√
TANZANIA	FA	84	62.01	TANZANIA	FJ	34	53.29	0.2099	X	X
TANZANIA	MJ	39	36.33	TANZANIA	FJ	34	37.76	0.7737	X	X
HEHE	MA	111	122.82	REST.TANZ.	MA	154	140.33	0.0665	X	X
TUTSI	MA	10	102.25	REST.TANZ.	MA	255	134.21	0.1959	X	X
SUKUMA	MA	49	147.17	REST.TANZ.	MA	216	129.78	0.1516	X	X
NYAKYUSA	MA	77	141.39	REST.TANZ.	MA	188	129.56	0.2541	X	X
KINGA	MA	18	138.36	REST.TANZ.	MA	247	132.61	0.7585	X	X
HEHE	MA	111	87.00	HEHE	FA	62	87.01	0.9987	X	X
HEHE	MA	111	73.48	HEHE	MJ	31	64.40	0.2773	X	X
HEHE	FA	62	48.46	HEHE	FJ	30	42.45	0.3115	X	X
HEHE	MJ	31	31.35	HEHE	FJ	30	30.63	0.8739	X	X
TUTSI	MA	10	11.50	TUTSI	FA	15	14.00	0.4052	X	X
TUTSI	MA	10	10.00	TUTSI	MJ	8	8.88	0.6965	X	X
TUTSI	FA	15	10.27	TUTSI	FJ	4	9.00	0.7363	X	X
TUTSI	MJ	8	5.50	TUTSI	FJ	4	8.50	0.2141	X	X
HEHE	MA	111	61.83	TUTSI	MA	10	51.80	0.3865	X	X
HEHE	FA	62	38.61	TUTSI	FA	15	40.60	0.7576	X	X
HEHE	MA	111	76.15	SUKUMA	MA	49	90.35	0.0741	X	X
HEHE	MA	111	89.02	NYAKYUSA	MA	77	102.40	0.0975	X	X
HEHE	MA	111	63.82	KINGA	MA	18	72.28	0.3732	X	X
TUTSI	MA	10	22.00	SUKUMA	MA	49	31.63	0.1060	X	X
TUTSI	MA	10	33.10	NYAKYUSA	MA	77	45.42	0.1469	X	X
TUTSI	MA	10	11.85	KINGA	MA	18	15.97	0.2079	X	X
SUKUMA	MA	49	65.36	NYAKYUSA	MA	77	63.32	0.6488	X	X
SUKUMA	MA	49	34.84	KINGA	MA	18	31.72	0.5619	X	X
KINGA	MA	18	46.89	NYAKYUSA	MA	77	48.26	0.8494	X	X

Table A3.44 - Mouth-Nose Width Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	353	238.81	ALL	FA	138	264.40	0.0723	X	X
TANZANIA	MA	248	154.89	G.B.	MA	99	221.86	0.0000	✓	✓
TANZANIA	FA	68	50.96	G.B.	FA	69	86.78	0.0000	✓	✓
G.B.	MA	99	81.86	G.B.	FA	69	88.29	0.3991	X	X
N.E.G.B.	MA	35	52.93	REST.G.B.	MA	64	48.40	0.4531	X	X
N.E.G.B.	FA	19	45.11	REST.G.B.	FA	50	31.16	0.0099	✓	✓
N.E.G.B.	MA	35	24.49	N.E.G.B.	FA	19	33.05	0.0560	X	X
REST. G.B	MA	64	57.33	REST.G.B.	FA	50	57.72	0.9499	X	X
TANZANIA	MA	248	161.25	TANZANIA	FA	68	148.48	0.3072	X	X
TANZANIA	MA	248	141.10	TANZANIA	MJ	33	140.21	0.9527	X	X
TANZANIA	FA	68	47.64	TANZANIA	FJ	31	55.18	0.2259	X	X
TANZANIA	MJ	33	30.94	TANZANIA	FJ	31	34.16	0.4888	X	X
HEHE	MA	105	114.73	REST.TANZ.	MA	143	131.67	0.0662	X	X
TUTSI	MA	3	208.33	REST.TANZ.	MA	245	123.47	0.0417	✓	X
SUKUMA	MA	48	153.92	REST.TANZ.	MA	200	117.44	0.0016	✓	✓
NYAKYUSA	MA	74	128.80	REST.TANZ.	MA	174	122.67	0.5384	X	X
KINGA	MA	18	71.39	REST.TANZ.	MA	230	128.66	0.0011	✓	✓
HEHE	MA	105	80.34	HEHE	FA	55	80.81	0.9413	X	X
HEHE	MA	105	66.18	HEHE	MJ	29	72.29	0.4526	X	X
HEHE	FA	55	41.03	HEHE	FJ	30	46.62	0.3183	X	X
HEHE	MJ	29	29.10	HEHE	FJ	30	30.87	0.6933	X	X
TUTSI	MA	3	6.00	TUTSI	FA	6	4.50	0.5476	X	X
TUTSI	MA	3	5.67	TUTSI	MJ	4	2.75	0.1143	X	X
TUTSI	FA	6	4.00	TUTSI	FJ	1	4.00	1.0000	X	X
TUTSI	MJ	4	2.75	TUTSI	FJ	1	4.00	0.8000	X	X
HEHE	MA	105	53.39	TUTSI	MA	13	93.33	0.0239	✓	X
HEHE	FA	55	29.71	TUTSI	FA	6	42.83	0.0881	X	X
HEHE	MA	105	69.57	SUKUMA	MA	48	93.25	0.0022	✓	✓
HEHE	MA	105	84.76	NYAKYUSA	MA	74	96.01	0.1924	X	X
HEHE	MA	105	65.01	KINGA	MA	18	44.44	0.0237	✓	X
TUTSI	MA	3	38.33	SUKUMA	MA	48	25.23	0.1518	X	X
TUTSI	MA	3	62.67	NYAKYUSA	MA	74	38.04	0.0624	X	X
TUTSI	MA	3	20.00	KINGA	MA	18	9.50	0.0015	✓	✓
SUKUMA	MA	48	69.14	NYAKYUSA	MA	74	56.55	0.0547	X	X
SUKUMA	MA	48	39.80	KINGA	MA	18	16.69	0.0000	✓	✓
KINGA	MA	18	29.25	NYAKYUSA	MA	74	50.70	0.0022	✓	✓

Table A3.45 - Biocular Mouth Width Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	1%
ALL	MA	353	222.54	ALL	FA	138	306.81	0.0000	√	√
TANZANIA	MA	248	150.11	G.B.	MA	99	233.83	0.0000	√	√
TANZANIA	FA	68	57.05	G.B.	FA	69	80.78	0.0005	√	√
G.B.	MA	99	78.55	G.B.	FA	69	93.04	0.0576	X	X
N.E.G.B.	MA	35	46.13	REST.G.B.	MA	64	52.12	0.3213	X	X
N.E.G.B.	FA	19	24.89	REST.G.B.	FA	50	38.84	0.0099	√	√
N.E.G.B.	MA	35	27.87	N.E.G.B.	FA	19	26.82	0.8138	X	X
REST. G.B	MA	64	51.98	REST.G.B.	FA	50	64.57	0.0435	√	X
TANZANIA	MA	248	147.25	TANZANIA	FA	68	199.53	0.0000	√	√
TANZANIA	MA	248	134.01	TANZANIA	MJ	33	193.53	0.0001	√	√
TANZANIA	FA	68	48.84	TANZANIA	FJ	31	52.55	0.5511	X	X
TANZANIA	MJ	33	32.74	TANZANIA	FJ	31	32.24	0.9144	X	X
HEHE	MA	105	134.69	REST.TANZ.	MA	143	117.02	0.0552	X	X
TUTSI	MA	3	131.00	REST.TANZ.	MA	245	124.42	0.8745	X	X
SUKUMA	MA	48	95.31	REST.TANZ.	MA	200	131.50	0.0017	√	√
NYAKYUSA	MA	74	119.67	REST.TANZ.	MA	174	126.55	0.4892	X	X
KINGA	MA	18	161.67	REST.TANZ.	MA	230	121.59	0.0225	√	X
HEHE	MA	105	73.98	HEHE	FA	55	92.95	0.0139	√	X
HEHE	MA	105	63.33	HEHE	MJ	29	82.59	0.0181	√	X
HEHE	FA	55	41.28	HEHE	FJ	30	46.15	0.3848	X	X
HEHE	MJ	29	29.26	HEHE	FJ	30	30.72	0.7444	X	X
TUTSI	MA	3	4.33	TUTSI	FA	6	5.33	0.7143	X	X
TUTSI	MA	3	2.00	TUTSI	MJ	4	5.50	0.0571	X	X
TUTSI	FA	6	4.17	TUTSI	FJ	1	3.00	0.8571	X	X
TUTSI	MJ	4	3.50	TUTSI	FJ	1	1.00	0.4000	X	X
HEHE	MA	105	54.54	TUTSI	MA	3	53.00	0.9440	X	X
HEHE	FA	55	31.53	TUTSI	FA	6	26.17	0.4996	X	X
HEHE	MA	105	84.65	SUKUMA	MA	48	60.26	0.0016	√	√
HEHE	MA	105	94.39	NYAKYUSA	MA	74	83.78	0.1774	X	X
HEHE	MA	105	60.11	KINGA	MA	18	73.03	0.1555	X	X
TUTSI	MA	3	34.00	SUKUMA	MA	48	25.50	0.3639	X	X
TUTSI	MA	3	42.33	NYAKYUSA	MA	74	38.86	0.8138	X	X
TUTSI	MA	3	7.67	KINGA	MA	18	11.56	0.3564	X	X
SUKUMA	MA	48	54.70	NYAKYUSA	MA	74	65.91	0.0870	X	X
SUKUMA	MA	48	28.35	KINGA	MA	18	47.22	0.0004	√	√
KINGA	MA	18	58.36	NYAKYUSA	MA	74	43.61	0.0356	√	X

Table A3.46 - Interoccular - Nasal Width Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	241.73	ALL	FA	155	315.60	0.0000	✓	✓
TANZANIA	MA	265	161.85	G.B.	MA	99	237.76	0.0000	✓	✓
TANZANIA	FA	84	69.59	G.B.	FA	70	86.00	0.0159	✓	X
G.B.	MA	99	81.60	G.B.	FA	70	89.81	0.2818	X	X
N.E.G.B.	MA	35	52.26	REST.G.B.	MA	64	48.77	0.5269	X	X
N.E.G.B.	FA	19	37.92	REST.G.B.	FA	51	34.60	0.5428	X	X
N.E.G.B.	MA	35	26.41	N.E.G.B.	FA	19	29.50	0.4906	X	X
REST. G.B	MA	64	55.51	REST.G.B.	FA	51	61.13	0.3690	X	X
TANZANIA	MA	165	162.96	TANZANIA	FA	84	212.99	0.0001	✓	✓
TANZANIA	MA	265	143.56	TANZANIA	MJ	39	213.27	0.0000	✓	✓
TANZANIA	FA	84	57.90	TANZANIA	FJ	34	63.44	0.4259	X	X
TANZANIA	MJ	39	38.79	TANZANIA	FJ	34	34.94	0.4388	X	X
HEHE	MA	111	131.76	REST.TANZ.	MA	154	133.90	0.8226	X	X
TUTSI	MA	10	191.00	REST.TANZ.	MA	255	130.73	0.0147	✓	X
SUKUMA	MA	49	138.83	REST.TANZ.	MA	216	131.68	0.5555	X	X
NYAKYUSA	MA	77	127.34	REST.TANZ.	MA	188	135.32	0.4415	X	X
KINGA	MA	18	116.81	REST.TANZ.	MA	247	134.18	0.3531	X	X
HEHE	MA	111	79.03	HEHE	FA	62	101.27	0.0051	✓	✓
HEHE	MA	111	64.66	HEHE	MJ	31	95.98	0.0002	✓	✓
HEHE	FA	62	44.19	HEHE	FJ	30	51.27	0.2336	X	X
HEHE	MJ	31	31.68	HEHE	FJ	30	30.30	0.7619	X	X
TUTSI	MA	10	12.05	TUTSI	FA	15	13.63	0.6047	X	X
TUTSI	MA	10	8.50	TUTSI	MJ	8	10.75	0.4082	X	X
TUTSI	FA	15	10.67	TUTSI	FJ	4	7.50	0.3571	X	X
TUTSI	MJ	8	7.13	TUTSI	FJ	4	5.25	0.4600	X	X
HEHE	MA	111	58.71	TUTSI	MA	10	86.45	0.0166	✓	X
HEHE	FA	62	36.33	TUTSI	FA	15	50.03	0.0333	✓	X
HEHE	MA	111	79.12	SUKUMA	MA	49	83.62	0.5711	X	X
HEHE	MA	111	95.88	NYAKYUSA	MA	77	92.51	0.6757	X	X
HEHE	MA	111	66.05	KINGA	MA	18	58.56	0.4304	X	X
TUTSI	MA	10	40.15	SUKUMA	MA	49	27.93	0.0403	✓	X
TUTSI	MA	10	61.40	NYAKYUSA	MA	77	41.74	0.0206	✓	X
TUTSI	MA	10	19.50	KINGA	MA	18	11.72	0.0156	✓	X
SUKUMA	MA	49	66.70	NYAKYUSA	MA	77	61.46	0.4320	X	X
SUKUMA	MA	49	35.57	KINGA	MA	18	29.72	0.2760	X	X
KINGA	MA	18	45.31	NYAKYUSA	MA	77	48.63	0.6451	X	X

APPENDIX 3(f) - MANN-WHITNEY U TEST RESULTS - INDICES USING PROFILE ONLY

Table A3.47 - Upper Face - Forehead Height Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	1%
ALL	MA	371	259.94	ALL	FA	143	251.16	0.5482	X	X
TANZANIA	MA	265	188.77	G.B.	MA	99	165.71	0.0628	X	X
TANZANIA	FA	82	73.54	G.B.	FA	60	68.72	0.4903	X	X
G.B.	MA	99	79.43	G.B.	FA	60	80.94	0.8408	X	X
N.E.G.B.	MA	35	45.29	REST.G.B.	MA	64	52.58	0.2270	X	X
N.E.G.B.	FA	18	21.31	REST.G.B.	FA	42	34.44	0.0075	√	√
N.E.G.B.	MA	35	28.83	N.E.G.B.	FA	18	23.44	0.2273	X	X
REST. G.B	MA	64	51.60	REST.G.B.	FA	42	56.39	0.4325	X	X
TANZANIA	MA	265	175.74	TANZANIA	FA	82	168.37	0.5606	X	X
TANZANIA	MA	265	155.58	TANZANIA	MJ	38	127.01	0.0601	X	X
TANZANIA	FA	82	64.63	TANZANIA	FJ	35	45.81	0.0060	√	√
TANZANIA	MJ	38	39.59	TANZANIA	FJ	35	34.19	0.2767	X	X
HEHE	MA	111	148.23	REST.TANZ	MA	154	122.02	0.0060	√	√
TUTSI	MA	11	88.68	REST.TANZ	MA	254	134.92	0.0501	X	X
SUKUMA	MA	48	123.97	REST.TANZ	MA	217	135.00	0.3669	X	X
NYAKYUSA	MA	78	128.68	REST.TANZ	MA	187	134.80	0.5534	X	X
KINGA	MA	17	107.53	REST.TANZ	MA	248	134.75	0.1566	X	X
HEHE	MA	111	88.63	HEHE	FA	62	84.08	0.5666	X	X
HEHE	MA	111	73.99	HEHE	MJ	31	62.58	0.1721	X	X
HEHE	FA	62	52.92	HEHE	FJ	31	35.16	0.0028	√	√
HEHE	MJ	31	35.94	HEHE	FJ	31	27.06	0.0529	X	X
TUTSI	MA	11	12.64	TUTSI	FA	13	12.38	0.9547	X	X
TUTSI	MA	11	11.82	TUTSI	MJ	7	5.86	0.0204	√	X
TUTSI	FA	13	10.31	TUTSI	FJ	4	4.75	0.0597	X	X
TUTSI	MJ	7	5.79	TUTSI	FJ	4	6.38	0.7879	X	X
HEHE	MA	111	63.85	TUTSI	MA	11	37.82	0.0199	√	X
HEHE	FA	62	40.90	TUTSI	FA	13	24.19	0.0120	√	X
HEHE	MA	111	84.55	SUKUMA	MA	48	69.49	0.0584	X	X
HEHE	MA	111	100.66	NYAKYUSA	MA	78	86.94	0.0896	X	X
HEHE	MA	111	67.18	KINGA	MA	17	47.00	0.0367	√	X
TUTSI	MA	11	22.73	SUKUMA	MA	48	31.67	0.1195	X	X
TUTSI	MA	11	33.36	NYAKYUSA	MA	78	46.64	0.1105	X	X
TUTSI	MA	11	12.77	KINGA	MA	17	15.62	0.3777	X	X
SUKUMA	MA	48	62.21	NYAKYUSA	MA	78	64.29	0.7554	X	X
SUKUMA	MA	48	34.10	KINGA	MA	17	29.88	0.4288	X	X
KINGA	MA	17	42.03	NYAKYUSA	MA	78	49.30	0.3243	X	X

Table A3.48 - Upper - Lower Facial Height Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	249.07	ALL	FA	153	293.86	0.0010	✓	✓
TANZANIA	MA	267	173.94	G.B.	MA	98	207.68	0.0067	✓	✓
TANZANIA	FA	83	63.65	G.B.	FA	69	91.93	0.0001	✓	✓
G.B.	MA	98	75.11	G.B.	FA	69	96.62	0.0045	✓	✓
N.E.G.B.	MA	35	44.09	REST.G.B.	MA	63	52.51	0.1579	X	X
N.E.G.B.	FA	18	30.56	REST.G.B.	FA	51	36.57	0.2735	X	X
N.E.G.B.	MA	35	24.81	N.E.G.B.	FA	18	31.25	0.1494	X	X
REST. G.B.	MA	63	51.18	REST.G.B.	FA	51	65.30	0.0229	✓	X
TANZANIA	MA	267	171.98	TANZANIA	FA	83	186.83	0.2425	X	X
TANZANIA	MA	267	150.28	TANZANIA	MJ	38	172.13	0.1528	X	X
TANZANIA	FA	83	58.43	TANZANIA	FJ	35	62.03	0.6013	X	X
TANZANIA	MJ	38	36.80	TANZANIA	FJ	35	37.21	0.9339	X	X
HEHE	MA	112	138.59	REST.TANZ.	MA	155	130.68	0.4089	X	X
TUTSI	MA	11	109.55	REST.TANZ.	MA	256	135.05	0.2833	X	X
SUKUMA	MA	48	147.24	REST.TANZ.	MA	219	131.05	0.1895	X	X
NYAKYUSA	MA	78	127.93	REST.TANZ.	MA	189	136.51	0.4091	X	X
KINGA	MA	18	111.39	REST.TANZ.	MA	249	135.63	0.1982	X	X
HEHE	MA	112	85.66	HEHE	FA	63	92.15	0.4140	X	X
HEHE	MA	112	69.94	HEHE	MJ	31	79.45	0.2574	X	X
HEHE	FA	63	46.82	HEHE	FJ	31	48.89	0.7290	X	X
HEHE	MJ	31	31.55	HEHE	FJ	31	31.45	0.9831	X	X
TUTSI	MA	11	11.36	TUTSI	FA	13	13.46	0.4940	X	X
TUTSI	MA	11	8.64	TUTSI	MJ	7	10.86	0.4252	X	X
TUTSI	FA	13	8.00	TUTSI	FJ	4	12.25	0.1630	X	X
TUTSI	MJ	7	5.14	TUTSI	FJ	4	7.50	0.3152	X	X
HEHE	MA	112	63.28	TUTSI	MA	11	48.95	0.2033	X	X
HEHE	FA	63	39.83	TUTSI	FA	13	32.04	0.2454	X	X
HEHE	MA	112	78.93	SUKUMA	MA	48	84.17	0.5120	X	X
HEHE	MA	112	98.54	NYAKYUSA	MA	78	91.13	0.3611	X	X
HEHE	MA	112	67.34	KINGA	MA	18	54.06	0.1647	X	X
TUTSI	MA	11	22.05	SUKUMA	MA	48	31.82	0.0883	X	X
TUTSI	MA	11	41.55	NYAKYUSA	MA	78	45.49	0.6357	X	X
TUTSI	MA	11	15.00	KINGA	MA	18	15.00	1.0000	X	X
SUKUMA	MA	48	68.79	NYAKYUSA	MA	78	60.24	0.2018	X	X
SUKUMA	MA	48	35.96	KINGA	MA	18	26.94	0.0889	X	X
KINGA	MA	18	43.89	NYAKYUSA	MA	78	49.56	0.4359	X	X

Table A3.49 - Lower Face - Forehead Height Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	370	267.57	ALL	FA	143	229.66	0.0094	√	√
TANZANIA	MA	265	195.43	G.B.	MA	98	145.69	0.0001	√	√
TANZANIA	FA	82	80.74	G.B.	FA	60	58.87	0.0017	√	√
G.B.	MA	98	83.38	G.B.	FA	60	73.17	0.1732	X	X
N.E.G.B.	MA	35	47.99	REST.G.B.	MA	63	50.34	0.6943	X	X
N.E.G.B.	FA	18	22.92	REST.G.B.	FA	42	33.75	0.0275	√	X
N.E.G.B.	MA	35	30.23	N.E.G.B.	FA	18	20.72	0.0335	√	X
REST. G.B.	MA	63	53.99	REST.G.B.	FA	42	51.51	0.6826	X	X
TANZANIA	MA	265	178.06	TANZANIA	FA	82	160.89	0.1757	X	X
TANZANIA	MA	265	157.93	TANZANIA	MJ	38	110.63	0.0019	√	√
TANZANIA	FA	82	66.51	TANZANIA	FJ	35	41.40	0.0002	√	√
TANZANIA	MJ	38	40.63	TANZANIA	FJ	35	33.06	0.1275	X	X
HEHE	MA	111	148.02	REST.TANZ.	MA	154	122.17	0.0067	√	√
TUTSI	MA	11	104.36	REST.TANZ.	MA	254	134.24	0.2056	X	X
SUKUMA	MA	48	111.54	REST.TANZ.	MA	217	127.75	0.0321	√	X
NYAKYUSA	MA	78	129.88	REST.TANZ.	MA	187	134.30	0.6691	X	X
KINGA	MA	17	128.32	REST.TANZ.	MA	248	133.32	0.7948	X	X
HEHE	MA	111	90.21	HEHE	FA	62	81.25	0.2591	X	X
HEHE	MA	111	76.11	HEHE	MJ	31	55.00	0.0115	√	X
HEHE	FA	62	54.00	HEHE	FJ	31	32.87	0.0004	√	√
HEHE	MJ	31	36.92	HEHE	FJ	31	26.08	0.0180	√	X
TUTSI	MA	11	13.36	TUTSI	FA	13	11.77	0.6085	X	X
TUTSI	MA	11	11.82	TUTSI	MJ	7	5.86	0.0204	√	X
TUTSI	FA	13	11.00	TUTSI	FJ	4	2.50	0.0008	√	√
TUTSI	MJ	7	5.79	TUTSI	FJ	4	6.38	0.7879	X	X
HEHE	MA	111	63.27	TUTSI	MA	11	43.64	0.0790	X	X
HEHE	FA	62	40.68	TUTSI	FA	13	25.23	0.0202	√	X
HEHE	MA	111	86.32	SUKUMA	MA	48	65.38	0.0084	√	√
HEHE	MA	111	100.59	NYAKYUSA	MA	78	87.04	0.0935	X	X
HEHE	MA	111	65.83	KINGA	MA	17	55.79	0.2987	X	X
TUTSI	MA	11	27.45	SUKUMA	MA	48	30.58	0.5858	X	X
TUTSI	MA	11	37.91	NYAKYUSA	MA	78	46.00	0.3309	X	X
TUTSI	MA	11	13.36	KINGA	MA	17	15.24	0.5784	X	X
SUKUMA	MA	48	57.33	NYAKYUSA	MA	78	67.29	0.1370	X	X
SUKUMA	MA	48	31.75	KINGA	MA	17	36.53	0.3704	X	X
KINGA	MA	17	47.76	NYAKYUSA	MA	78	48.05	0.9690	X	X

Table A3.50 - Lower Face Proportion Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	370	261.89	ALL	FA	151	252.81	0.8321	X	X
TANZANIA	MA	266	171.01	G.B.	MA	97	212.13	0.0010	✓	✓
TANZANIA	FA	83	71.58	G.B.	FA	67	80.35	0.2192	X	X
G.B.	MA	97	86.80	G.B.	FA	67	76.28	0.1630	X	X
N.E.G.B.	MA	34	45.63	REST.G.B.	MA	63	50.82	0.3865	X	X
N.E.G.B.	FA	19	34.66	REST.G.B.	FA	48	33.74	0.8619	X	X
N.E.G.B.	MA	34	27.38	N.E.G.B.	FA	19	26.32	0.8094	X	X
REST. G.B.	MA	63	59.98	REST.G.B.	FA	48	50.77	0.1351	X	X
TANZANIA	MA	266	175.16	TANZANIA	FA	83	174.49	0.9583	X	X
TANZANIA	MA	266	155.54	TANZANIA	MJ	38	123.42	0.0292	✓	X
TANZANIA	FA	83	63.91	TANZANIA	FJ	35	49.04	0.0310	✓	X
TANZANIA	MJ	38	37.84	TANZANIA	FJ	35	36.09	0.7238	X	X
HEHE	MA	111	122.39	REST.TANZ.	MA	155	141.46	0.0462	✓	X
TUTSI	MA	11	131.23	REST.TANZ.	MA	255	133.60	0.9203	X	X
SUKUMA	MA	48	159.49	REST.TANZ.	MA	218	127.79	0.0098	✓	✓
NYAKYUSA	MA	78	136.13	REST.TANZ.	MA	188	132.41	0.7197	X	X
KINGA	MA	18	122.83	REST.TANZ.	MA	248	134.27	0.5423	X	X
HEHE	MA	111	86.54	HEHE	FA	63	89.19	0.7387	X	X
HEHE	MA	111	74.69	HEHE	MJ	31	60.06	0.0800	X	X
HEHE	FA	63	51.55	HEHE	FJ	31	39.27	0.0403	✓	X
HEHE	MJ	31	32.16	HEHE	FJ	31	30.84	0.7728	X	X
TUTSI	MA	11	9.64	TUTSI	FA	13	14.92	0.0720	X	X
TUTSI	MA	11	9.32	TUTSI	MJ	7	9.79	0.8601	X	X
TUTSI	FA	13	9.62	TUTSI	FJ	4	7.00	0.4118	X	X
TUTSI	MJ	7	5.71	TUTSI	FJ	4	6.50	0.7879	X	X
HEHE	MA	111	61.09	TUTSI	MA	11	65.59	0.6875	X	X
HEHE	FA	63	35.35	TUTSI	FA	13	53.77	0.0062	✓	✓
HEHE	MA	111	73.35	SUKUMA	MA	48	95.38	0.0056	✓	✓
HEHE	MA	111	91.16	NYAKYUSA	MA	78	100.47	0.2493	X	X
HEHE	MA	111	64.78	KINGA	MA	18	66.33	0.8794	X	X
TUTSI	MA	11	24.77	SUKUMA	MA	48	31.20	0.2630	X	X
TUTSI	MA	11	43.41	NYAKYUSA	MA	78	45.22	0.8273	X	X
TUTSI	MA	11	15.45	KINGA	MA	18	14.72	0.8424	X	X
SUKUMA	MA	48	70.19	NYAKYUSA	MA	78	59.38	0.1068	X	X
SUKUMA	MA	48	36.19	KINGA	MA	18	26.33	0.0632	X	X
KINGA	MA	18	43.94	NYAKYUSA	MA	78	49.55	0.4414	X	X

Table A3.51 - Nasal Height - Prominence Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	373	248.24	ALL	FA	153	300.69	0.0003	✓	✓
TANZANIA	MA	267	202.45	G.B.	MA	99	132.38	0.0000	✓	✓
TANZANIA	FA	82	94.63	G.B.	FA	70	55.26	0.0000	✓	✓
G.B.	MA	99	75.88	G.B.	FA	70	97.90	0.0039	✓	✓
N.E.G.B.	MA	35	51.53	REST.G.B.	MA	64	49.16	0.6953	X	X
N.E.G.B.	FA	19	38.84	REST.G.B.	FA	51	34.25	0.4015	X	X
N.E.G.B.	MA	35	25.01	N.E.G.B.	FA	19	32.08	0.1150	X	X
REST. G.B.	MA	64	51.31	REST.G.B.	FA	51	66.39	0.0159	✓	X
TANZANIA	MA	267	162.05	TANZANIA	FA	82	217.17	0.0000	✓	✓
TANZANIA	MA	267	144.11	TANZANIA	MJ	38	215.43	0.0000	✓	✓
TANZANIA	FA	82	56.77	TANZANIA	FJ	35	64.23	0.2758	X	X
TANZANIA	MJ	38	38.01	TANZANIA	FJ	35	35.90	0.6707	X	X
HEHE	MA	112	143.01	REST.TANZ.	MA	155	127.49	0.1051	X	X
TUTSI	MA	11	113.91	REST.TANZ.	MA	256	134.86	0.3781	X	X
SUKUMA	MA	48	115.32	REST.TANZ.	MA	219	138.09	0.0642	X	X
NYAKYUSA	MA	78	133.25	REST.TANZ.	MA	189	134.31	0.9188	X	X
KINGA	MA	18	143.28	REST.TANZ.	MA	249	133.33	0.5976	X	X
HEHE	MA	112	80.25	HEHE	FA	62	100.59	0.0107	✓	X
HEHE	MA	112	64.86	HEHE	MJ	31	97.79	0.0001	✓	✓
HEHE	FA	62	44.63	HEHE	FJ	31	51.74	0.2308	X	X
HEHE	MJ	31	32.65	HEHE	FJ	31	30.35	0.6171	X	X
TUTSI	MA	11	9.45	TUTSI	FA	13	15.08	0.0548	X	X
TUTSI	MA	11	8.55	TUTSI	MJ	7	11.00	0.3749	X	X
TUTSI	FA	13	9.54	TUTSI	FJ	4	7.25	0.4773	X	X
TUTSI	MJ	7	5.86	TUTSI	FJ	4	6.25	0.9273	X	X
HEHE	MA	112	63.12	TUTSI	MA	11	50.59	0.2658	X	X
HEHE	FA	62	38.11	TUTSI	FA	13	37.46	0.9219	X	X
HEHE	MA	112	85.30	SUKUMA	MA	48	69.30	0.0453	✓	X
HEHE	MA	112	98.70	NYAKYUSA	MA	78	90.90	0.3363	X	X
HEHE	MA	112	65.39	KINGA	MA	18	66.19	0.9328	X	X
TUTSI	MA	11	29.05	SUKUMA	MA	48	30.22	0.8381	X	X
TUTSI	MA	11	39.18	NYAKYUSA	MA	78	45.82	0.4249	X	X
TUTSI	MA	11	13.09	KINGA	MA	18	16.17	0.3629	X	X
SUKUMA	MA	48	57.44	NYAKYUSA	MA	78	67.23	0.1437	X	X
SUKUMA	MA	48	31.86	KINGA	MA	18	37.86	0.2584	X	X
KINGA	MA	18	51.56	NYAKYUSA	MA	78	47.79	0.6056	X	X

Table A3.52 - Nasal Prominence - Bridge Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	270.56	ALL	FA	153	244.61	0.0748	X	X
TANZANIA	MA	266	101.84	G.B.	MA	99	159.24	0.0087	✓	✓
TANZANIA	FA	82	78.81	G.B.	FA	70	73.79	0.4836	X	X
G.B.	MA	99	85.63	G.B.	FA	70	84.11	0.8431	X	X
N.E.G.B.	MA	35	55.59	REST.G.B.	MA	64	46.95	0.1524	X	X
N.E.G.B.	FA	19	36.34	REST.G.B.	FA	51	35.19	0.8325	X	X
N.E.G.B.	MA	35	28.24	N.E.G.B.	FA	19	25.13	0.6376	X	X
REST. G.B	MA	64	57.01	REST.G.B.	FA	51	59.25	0.7207	X	X
TANZANIA	MA	266	177.87	TANZANIA	FA	82	163.55	0.2598	X	X
TANZANIA	MA	266	152.80	TANZANIA	MJ	38	150.37	0.8730	X	X
TANZANIA	FA	82	58.55	TANZANIA	FJ	35	60.06	0.8256	X	X
TANZANIA	MJ	38	37.92	TANZANIA	FJ	35	36.00	0.6990	X	X
HEHE	MA	111	147.06	REST.TANZ.	MA	155	123.79	0.0150	✓	X
TUTSI	MA	11	80.50	REST.TANZ.	MA	255	135.79	0.0196	✓	X
SUKUMA	MA	48	129.24	REST.TANZ.	MA	218	134.44	0.6717	X	X
NYAKYUSA	MA	78	129.21	REST.TANZ.	MA	188	135.28	0.5581	X	X
KINGA	MA	18	112.21	REST.TANZ.	MA	248	135.05	0.2236	X	X
HEHE	MA	111	91.56	HEHE	FA	62	78.84	0.1092	X	X
HEHE	MA	111	73.00	HEHE	MJ	31	66.15	0.4123	X	X
HEHE	FA	62	46.59	HEHE	FJ	31	47.82	0.8363	X	X
HEHE	MJ	31	32.08	HEHE	FJ	31	30.92	0.7999	X	X
TUTSI	MA	11	11.77	TUTSI	FA	13	13.12	0.6490	X	X
TUTSI	MA	11	8.91	TUTSI	MJ	7	10.43	0.5962	X	X
TUTSI	FA	13	9.04	TUTSI	FJ	4	8.88	0.9563	X	X
TUTSI	MJ	7	6.36	TUTSI	FJ	4	5.38	0.6485	X	X
HEHE	MA	111	64.09	TUTSI	MA	11	35.41	0.0103	✓	X
HEHE	FA	62	38.61	TUTSI	FA	13	35.08	0.5948	X	X
HEHE	MA	111	83.43	SUKUMA	MA	48	72.07	0.1534	X	X
HEHE	MA	111	100.50	NYAKYUSA	MA	78	87.17	0.0988	X	X
HEHE	MA	111	67.05	KINGA	MA	18	52.39	0.1228	X	X
TUTSI	MA	11	19.86	SUKUMA	MA	48	32.32	0.0300	✓	X
TUTSI	MA	11	29.73	NYAKYUSA	MA	78	47.15	0.0361	✓	X
TUTSI	MA	11	13.50	KINGA	MA	18	15.92	0.4647	X	X
SUKUMA	MA	48	63.27	NYAKYUSA	MA	78	63.64	0.9559	X	X
SUKUMA	MA	48	35.07	KINGA	MA	18	29.31	0.2770	X	X
KINGA	MA	18	43.08	NYAKYUSA	MA	78	49.75	0.3598	X	X

Table A3.53 - Whole Upper Lip Vertical Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	255.73	ALL	FA	151	275.67	0.1710	X	X
TANZANIA	MA	266	151.16	G.B.	MA	98	267.56	0.0000	√	√
TANZANIA	FA	83	53.03	G.B.	FA	67	103.34	0.0000	√	√
G.B.	MA	98	82.21	G.B.	FA	67	84.15	0.7983	X	X
N.E.G.B.	MA	34	49.87	REST.G.B.	MA	64	49.30	0.9257	X	X
N.E.G.B.	FA	19	30.61	REST.G.B.	FA	48	35.34	0.3695	X	X
N.E.G.B.	MA	34	27.74	N.E.G.B.	FA	19	25.68	0.6426	X	X
REST. G.B.	MA	64	55.30	REST.G.B.	FA	48	58.10	0.6507	X	X
TANZANIA	MA	266	177.82	TANZANIA	FA	83	165.96	0.3498	X	X
TANZANIA	MA	266	155.94	TANZANIA	MJ	38	128.45	0.0712	X	X
TANZANIA	FA	83	63.43	TANZANIA	FJ	35	50.17	0.0544	X	X
TANZANIA	MJ	38	38.41	TANZANIA	FJ	35	35.47	0.5546	X	X
HEHE	MA	111	125.41	REST.TANZ.	MA	155	139.29	0.1465	X	X
TUTSI	MA	11	100.64	REST.TANZ.	MA	255	134.92	0.1477	X	X
SUKUMA	MA	48	142.95	REST.TANZ.	MA	218	131.42	0.3471	X	X
NYAKYUSA	MA	78	142.88	REST.TANZ.	MA	188	129.61	0.2001	X	X
KINGA	MA	18	137.64	REST.TANZ.	MA	248	133.20	0.8131	X	X
HEHE	MA	111	90.74	HEHE	FA	63	81.79	0.2598	X	X
HEHE	MA	111	73.77	HEHE	MJ	31	63.39	0.2135	X	X
HEHE	FA	63	51.29	HEHE	FJ	31	39.79	0.0546	X	X
HEHE	MJ	31	33.58	HEHE	FJ	31	29.42	0.3637	X	X
TUTSI	MA	11	8.45	TUTSI	FA	13	15.92	0.0088	√	√
TUTSI	MA	11	8.18	TUTSI	MJ	7	11.57	0.2109	X	X
TUTSI	FA	13	9.08	TUTSI	FJ	4	8.75	0.9563	X	X
TUTSI	MJ	7	5.14	TUTSI	FJ	4	7.50	0.3152	X	X
HEHE	MA	111	62.74	TUTSI	MA	11	48.95	0.2166	X	X
HEHE	FA	63	34.88	TUTSI	FA	13	56.04	0.0017	√	√
HEHE	MA	111	76.74	SUKUMA	MA	48	87.54	0.1739	X	X
HEHE	MA	111	89.64	NYAKYUSA	MA	78	102.63	0.1075	X	X
HEHE	MA	111	64.29	KINGA	MA	18	69.36	0.5931	X	X
TUTSI	MA	11	24.18	SUKUMA	MA	48	31.33	0.2129	X	X
TUTSI	MA	11	32.86	NYAKYUSA	MA	78	46.71	0.0960	X	X
TUTSI	MA	11	12.64	KINGA	MA	18	16.44	0.2564	X	X
SUKUMA	MA	48	63.81	NYAKYUSA	MA	78	63.31	0.9399	X	X
SUKUMA	MA	48	33.76	KINGA	MA	18	32.81	0.8572	X	X
KINGA	MA	18	47.53	NYAKYUSA	MA	78	48.72	0.8695	X	X

Table A3.54 - Lower Facial Height Vertical Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	273.90	ALL	FA	154	238.38	0.0147	✓	X
TANZANIA	MA	267	216.10	G.B.	MA	98	92.81	0.0000	✓	✓
TANZANIA	FA	83	104.87	G.B.	FA	70	43.95	0.0000	✓	✓
G.B.	MA	98	89.28	G.B.	FA	70	77.81	0.1317	X	X
N.E.G.B.	MA	35	47.70	REST.G.B.	MA	63	50.50	0.6404	X	X
N.E.G.B.	FA	19	41.53	REST.G.B.	FA	51	33.25	0.1304	X	X
N.E.G.B.	MA	35	26.67	N.E.G.B.	FA	19	29.03	0.5993	X	X
REST. G.B.	MA	63	63.10	REST.G.B.	FA	51	50.59	0.0445	✓	X
TANZANIA	MA	267	173.74	TANZANIA	FA	83	181.16	0.5594	X	X
TANZANIA	MA	267	151.48	TANZANIA	MJ	38	163.67	0.4253	X	X
TANZANIA	FA	83	56.95	TANZANIA	FJ	35	65.54	0.2127	X	X
TANZANIA	MJ	38	35.30	TANZANIA	FJ	35	38.84	0.4763	X	X
HEHE	MA	112	135.74	REST.TANZ.	MA	155	132.75	0.7548	X	X
TUTSI	MA	11	161.14	REST.TANZ.	MA	256	132.83	0.2339	X	X
SUKUMA	MA	48	143.07	REST.TANZ.	MA	219	132.01	0.3687	X	X
NYAKYUSA	MA	78	125.61	REST.TANZ.	MA	189	137.46	0.2540	X	X
KINGA	MA	18	118.78	REST.TANZ.	MA	249	135.10	0.3865	X	X
HEHE	MA	112	85.37	HEHE	FA	63	92.68	0.3591	X	X
HEHE	MA	112	70.67	HEHE	MJ	31	76.82	0.4639	X	X
HEHE	FA	63	44.66	HEHE	FJ	31	53.27	0.1500	X	X
HEHE	MJ	31	29.08	HEHE	FJ	31	33.92	0.2910	X	X
TUTSI	MA	11	14.18	TUTSI	FA	13	11.08	0.3031	X	X
TUTSI	MA	11	10.27	TUTSI	MJ	7	8.29	0.4789	X	X
TUTSI	FA	13	9.35	TUTSI	FJ	4	7.75	0.6235	X	X
TUTSI	MJ	7	6.57	TUTSI	FJ	4	5.00	0.5273	X	X
HEHE	MA	112	60.96	TUTSI	MA	11	72.59	0.3018	X	X
HEHE	FA	63	40.06	TUTSI	FA	13	30.92	0.1742	X	X
HEHE	MA	112	79.26	SUKUMA	MA	48	83.30	0.6061	X	X
HEHE	MA	112	98.43	NYAKYUSA	MA	78	91.20	0.3791	X	X
HEHE	MA	112	66.58	KINGA	MA	18	58.75	0.4128	X	X
TUTSI	MA	11	32.91	SUKUMA	MA	48	29.33	0.5334	X	X
TUTSI	MA	11	55.91	NYAKYUSA	MA	78	43.46	0.1347	X	X
TUTSI	MA	11	17.73	KINGA	MA	18	13.33	0.1881	X	X
SUKUMA	MA	48	68.77	NYAKYUSA	MA	78	60.26	0.2037	X	X
SUKUMA	MA	48	35.08	KINGA	MA	18	29.28	0.2738	X	X
KINGA	MA	18	45.92	NYAKYUSA	MA	78	49.10	0.6625	X	X

Table A3.55 - Nasal Columella Length Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	268.71	ALL	FA	154	250.91	0.2214	X	X
TANZANIA	MA	267	193.85	G.B.	MA	98	153.45	0.0012	√	√
TANZANIA	FA	83	80.78	G.B.	FA	70	72.51	0.2500	X	X
G.B.	MA	98	82.27	G.B.	FA	70	87.63	0.4810	X	X
N.E.G.B.	MA	34	56.31	REST.G.B.	MA	64	45.88	0.0839	X	X
N.E.G.B.	FA	19	48.05	REST.G.B.	FA	51	30.82	0.0016	√	√
N.E.G.B.	MA	34	24.93	N.E.G.B.	FA	19	30.71	0.1905	X	X
REST. G.B.	MA	64	57.18	REST.G.B.	FA	51	59.03	0.7675	X	X
TANZANIA	MA	267	179.60	TANZANIA	FA	83	162.30	0.1734	X	X
TANZANIA	MA	267	152.63	TANZANIA	MJ	38	155.58	0.8472	X	X
TANZANIA	FA	83	58.42	TANZANIA	FJ	35	66.80	0.1320	X	X
TANZANIA	MJ	38	36.57	TANZANIA	FJ	35	37.47	0.8554	X	X
HEHE	MA	112	135.89	REST.TANZ.	MA	155	132.64	0.7341	X	X
TUTSI	MA	11	139.55	REST.TANZ.	MA	256	133.76	0.8078	X	X
SUKUMA	MA	48	115.46	REST.TANZ.	MA	219	138.06	0.0662	X	X
NYAKYUSA	MA	78	136.54	REST.TANZ.	MA	189	132.95	0.7294	X	X
KINGA	MA	18	157.28	REST.TANZ.	MA	249	132.32	0.1853	X	X
HEHE	MA	112	92.99	HEHE	FA	63	79.13	0.0822	X	X
HEHE	MA	112	72.36	HEHE	MJ	31	70.71	0.8446	X	X
HEHE	FA	63	44.07	HEHE	FJ	31	54.47	0.0822	X	X
HEHE	MJ	31	30.53	HEHE	FJ	31	32.47	0.6726	X	X
TUTSI	MA	11	12.50	TUTSI	FA	13	12.50	1.0000	X	X
TUTSI	MA	11	9.14	TUTSI	MJ	7	10.07	0.7242	X	X
TUTSI	FA	13	9.15	TUTSI	FJ	4	8.50	0.8706	X	X
TUTSI	MJ	7	6.50	TUTSI	FJ	4	5.13	0.5273	X	X
HEHE	MA	112	61.87	TUTSI	MA	11	63.32	0.8977	X	X
HEHE	FA	63	37.20	TUTSI	FA	13	44.81	0.2578	X	X
HEHE	MA	112	84.23	SUKUMA	MA	48	71.80	0.1200	X	X
HEHE	MA	112	95.22	NYAKYUSA	MA	78	95.90	0.9327	X	X
HEHE	MA	112	64.07	KINGA	MA	18	74.39	0.2807	X	X
TUTSI	MA	11	33.64	SUKUMA	MA	48	29.17	0.4361	X	X
TUTSI	MA	11	46.68	NYAKYUSA	MA	78	44.76	0.8176	X	X
TUTSI	MA	11	13.91	KINGA	MA	18	15.67	0.6109	X	X
SUKUMA	MA	48	57.52	NYAKYUSA	MA	78	67.18	0.1493	X	X
SUKUMA	MA	48	30.47	KINGA	MA	18	41.58	0.0361	√	X
KINGA	MA	18	54.14	NYAKYUSA	MA	78	47.20	0.3406	X	X

Table A3.56 - Lateral Proportion Index I

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	273.77	ALL	FA	153	235.18	0.0080	√	√
TANZANIA	MA	266	183.64	G.B.	MA	98	179.42	0.7345	X	X
TANZANIA	FA	82	89.19	G.B.	FA	70	61.64	0.0001	√	√
G.B.	MA	98	94.21	G.B.	FA	70	70.91	0.0022	√	√
N.E.G.B.	MA	35	53.73	REST.G.B.	MA	63	47.15	0.2725	X	X
N.E.G.B.	FA	19	34.34	REST.G.B.	FA	51	35.93	0.7714	X	X
N.E.G.B.	MA	35	31.13	N.E.G.B.	FA	19	20.82	0.0214	√	X
REST. G.B.	MA	63	63.37	REST.G.B.	FA	51	50.25	0.0350	√	X
TANZANIA	MA	266	175.32	TANZANIA	FA	82	171.85	0.7848	X	X
TANZANIA	MA	266	159.76	TANZANIA	MJ	38	101.68	0.0001	√	√
TANZANIA	FA	82	65.30	TANZANIA	FJ	35	44.23	0.0021	√	√
TANZANIA	MJ	38	36.62	TANZANIA	FJ	35	37.41	0.8728	X	X
HEHE	MA	111	103.35	REST.TANZ.	MA	155	155.09	0.0000	√	√
TUTSI	MA	11	140.23	REST.TANZ.	MA	255	133.21	0.7671	X	X
SUKUMA	MA	48	162.26	REST.TANZ.	MA	218	127.17	0.0042	√	√
NYAKYUSA	MA	78	158.16	REST.TANZ.	MA	188	123.27	0.0003	√	√
KINGA	MA	18	131.75	REST.TANZ.	MA	248	133.63	0.9204	X	X
HEHE	MA	111	80.29	HEHE	FA	62	99.01	0.0184	√	X
HEHE	MA	111	74.13	HEHE	MJ	31	62.08	0.1493	X	X
HEHE	FA	62	52.58	HEHE	FJ	31	35.84	0.0048	√	√
HEHE	MJ	31	31.39	HEHE	FJ	31	31.61	0.9607	X	X
TUTSI	MA	11	10.82	TUTSI	FA	13	13.92	0.3031	X	X
TUTSI	MA	11	11.00	TUTSI	MJ	7	7.14	0.1509	X	X
TUTSI	FA	13	9.85	TUTSI	FJ	4	6.25	0.2454	X	X
TUTSI	MJ	7	5.71	TUTSI	FJ	4	6.50	0.7879	X	X
HEHE	MA	111	59.77	TUTSI	MA	11	78.95	0.0861	X	X
HEHE	FA	62	35.94	TUTSI	FA	13	47.85	0.0732	X	X
HEHE	MA	111	69.50	SUKUMA	MA	48	104.28	0.0000	√	√
HEHE	MA	111	79.09	NYAKYUSA	MA	78	117.64	0.0000	√	√
HEHE	MA	111	62.99	KINGA	MA	18	77.39	0.1296	X	X
TUTSI	MA	11	25.18	SUKUMA	MA	48	31.10	0.3023	X	X
TUTSI	MA	11	38.45	NYAKYUSA	MA	78	45.92	0.3694	X	X
TUTSI	MA	11	15.64	KINGA	MA	18	14.61	0.7739	X	X
SUKUMA	MA	48	64.68	NYAKYUSA	MA	78	62.78	0.7765	X	X
SUKUMA	MA	48	35.70	KINGA	MA	18	27.64	0.1288	X	X
KINGA	MA	18	40.61	NYAKYUSA	MA	78	50.32	0.1825	X	X

Table A3.57 - Lateral Proportion Index II

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	264.99	ALL	FA	153	256.46	0.5574	X	X
TANZANIA	MA	266	153.66	G.B.	MA	98	260.78	0.0000	✓	✓
TANZANIA	FA	82	59.84	G.B.	FA	70	96.01	0.0000	✓	✓
G.B.	MA	98	94.10	G.B.	FA	70	71.06	0.0025	✓	✓
N.E.G.B.	MA	35	60.91	REST.G.B.	MA	63	43.16	0.0031	✓	✓
N.E.G.B.	FA	19	39.66	REST.G.B.	FA	51	33.95	0.2967	X	X
N.E.G.B.	MA	35	31.76	N.E.G.B.	FA	19	19.66	0.0069	✓	✓
REST. G.B.	MA	63	61.83	REST.G.B.	FA	51	52.15	0.1198	X	X
TANZANIA	MA	266	177.38	TANZANIA	FA	82	165.15	0.3359	X	X
TANZANIA	MA	266	161.55	TANZANIA	MJ	38	89.14	0.0000	✓	✓
TANZANIA	FA	82	65.38	TANZANIA	FJ	35	44.06	0.0018	✓	✓
TANZANIA	MJ	38	36.80	TANZANIA	FJ	35	37.21	0.9340	X	X
HEHE	MA	111	114.60	REST.TANZ.	MA	155	147.04	0.0007	✓	✓
TUTSI	MA	11	110.77	REST.TANZ.	MA	255	134.48	0.3170	X	X
SUKUMA	MA	48	126.72	REST.TANZ.	MA	218	134.99	0.4999	X	X
NYAKYUSA	MA	78	160.12	REST.TANZ.	MA	188	122.45	0.0003	✓	✓
KINGA	MA	18	166.67	REST.TANZ.	MA	248	131.09	0.0583	X	X
HEHE	MA	111	85.68	HEHE	FA	62	89.36	0.6428	X	X
HEHE	MA	111	76.95	HEHE	MJ	31	51.97	0.0028	✓	✓
HEHE	FA	62	52.52	HEHE	FJ	31	35.95	0.0052	✓	✓
HEHE	MJ	31	31.74	HEHE	FJ	31	31.26	0.9159	X	X
TUTSI	MA	11	10.73	TUTSI	FA	13	14.00	0.2707	X	X
TUTSI	MA	11	10.68	TUTSI	MJ	7	7.64	0.2463	X	X
TUTSI	FA	13	9.92	TUTSI	FJ	4	6.00	0.2017	X	X
TUTSI	MJ	7	5.71	TUTSI	FJ	4	6.50	0.7879	X	X
HEHE	MA	111	61.81	TUTSI	MA	11	58.36	0.7578	X	X
HEHE	FA	62	36.40	TUTSI	FA	13	45.62	0.1658	X	X
HEHE	MA	111	77.65	SUKUMA	MA	48	85.46	0.3256	X	X
HEHE	MA	111	81.68	NYAKYUSA	MA	78	113.96	0.0001	✓	✓
HEHE	MA	111	61.47	KINGA	MA	18	86.75	0.0078	✓	✓
TUTSI	MA	11	26.77	SUKUMA	MA	48	30.74	0.4896	X	X
TUTSI	MA	11	31.64	NYAKYUSA	MA	78	46.88	0.0669	X	X
TUTSI	MA	11	12.00	KINGA	MA	18	16.83	0.1462	X	X
SUKUMA	MA	48	53.32	NYAKYUSA	MA	78	69.76	0.0141	✓	X
SUKUMA	MA	48	30.70	KINGA	MA	18	40.97	0.0528	X	X
KINGA	MA	18	50.61	NYAKYUSA	MA	78	48.01	0.7213	X	X

Table A3.58 - Lateral Proportion Index III

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	268.57	ALL	FA	153	249.45	0.1895	X	X
TANZANIA	MA	267	215.12	G.B.	MA	98	95.50	0.0000	√	√
TANZANIA	FA	82	102.55	G.B.	FA	70	45.98	0.0000	√	√
G.B.	MA	98	79.01	G.B.	FA	70	92.19	0.8582	X	X
N.E.G.B.	MA	35	40.31	REST.G.B.	MA	63	54.60	0.0170	√	X
N.E.G.B.	FA	19	30.84	REST.G.B.	FA	51	37.24	0.2424	X	X
N.E.G.B.	MA	35	26.76	N.E.G.B.	FA	19	28.87	0.6369	X	X
REST. G.B.	MA	63	58.76	REST.G.B.	FA	51	55.94	0.6504	X	X
TANZANIA	MA	267	171.25	TANZANIA	FA	82	187.20	0.2108	X	X
TANZANIA	MA	267	149.73	TANZANIA	MJ	38	175.99	0.0859	X	X
TANZANIA	FA	82	57.38	TANZANIA	FJ	35	62.79	0.4303	X	X
TANZANIA	MJ	38	37.22	TANZANIA	FJ	35	36.76	0.9252	X	X
HEHE	MA	112	129.24	REST.TANZ.	MA	155	137.44	0.3915	X	X
TUTSI	MA	11	162.36	REST.TANZ.	MA	256	132.78	0.2135	X	X
SUKUMA	MA	48	162.43	REST.TANZ.	MA	219	127.77	0.0049	√	√
NYAKYUSA	MA	78	128.23	REST.TANZ.	MA	189	136.88	0.4329	X	X
KINGA	MA	18	95.50	REST.TANZ.	MA	249	136.78	0.0285	√	X
HEHE	MA	112	82.39	HEHE	FA	62	96.73	0.0720	X	X
HEHE	MA	112	69.35	HEHE	MJ	31	81.58	0.1457	X	X
HEHE	FA	62	46.19	HEHE	FJ	31	48.63	0.6806	X	X
HEHE	MJ	31	31.31	HEHE	FJ	31	31.69	0.9327	X	X
TUTSI	MA	11	13.32	TUTSI	FA	13	11.81	0.6085	X	X
TUTSI	MA	11	9.09	TUTSI	MJ	7	10.14	0.7242	X	X
TUTSI	FA	13	8.54	TUTSI	FJ	4	10.50	0.5487	X	X
TUTSI	MJ	7	6.00	TUTSI	FJ	4	6.00	1.0000	X	X
HEHE	MA	112	60.64	TUTSI	MA	11	75.82	0.1779	X	X
HEHE	FA	62	38.32	TUTSI	FA	13	36.46	0.7795	X	X
HEHE	MA	112	74.66	SUKUMA	MA	48	94.14	0.0148	√	X
HEHE	MA	112	95.66	NYAKYUSA	MA	78	95.27	0.9615	X	X
HEHE	MA	112	67.78	KINGA	MA	18	51.53	0.0856	X	X
TUTSI	MA	11	29.82	SUKUMA	MA	48	30.04	0.9690	X	X
TUTSI	MA	11	55.09	NYAKYUSA	MA	78	43.58	0.1664	X	X
TUTSI	MA	11	19.64	KINGA	MA	18	12.17	0.0214	√	X
SUKUMA	MA	48	73.54	NYAKYUSA	MA	78	57.32	0.0155	√	X
SUKUMA	MA	48	38.21	KINGA	MA	18	20.94	0.0011	√	√
KINGA	MA	18	39.56	NYAKYUSA	MA	78	50.56	0.1307	X	X

Table A3.59 - Nasal Prominence Lateral Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	372	260.07	ALL	FA	153	270.12	0.4963	X	X
TANZANIA	MA	267	228.11	G.B.	MA	98	60.10	0.0000	✓	✓
TANZANIA	FA	82	110.40	G.B.	FA	70	36.79	0.0000	✓	✓
G.B.	MA	98	79.01	G.B.	FA	70	92.19	0.0832	X	X
N.E.G.B.	MA	35	46.03	REST.G.B.	MA	63	51.43	0.3676	X	X
N.E.G.B.	FA	19	39.18	REST.G.B.	FA	51	34.13	0.3552	X	X
N.E.G.B.	MA	35	24.80	N.E.G.B.	FA	19	32.47	0.0869	X	X
REST. G.B.	MA	63	55.22	REST.G.B.	FA	51	60.31	0.4134	X	X
TANZANIA	MA	267	158.46	TANZANIA	FA	82	228.85	0.0000	✓	✓
TANZANIA	MA	267	141.45	TANZANIA	MJ	38	234.16	0.0000	✓	✓
TANZANIA	FA	82	54.55	TANZANIA	FJ	35	69.41	0.0300	✓	X
TANZANIA	MJ	38	37.00	TANZANIA	FJ	35	37.00	1.0000	X	X
HEHE	MA	112	137.76	REST.TANZ.	MA	155	131.28	0.4984	X	X
TUTSI	MA	11	162.36	REST.TANZ.	MA	256	132.78	0.2135	X	X
SUKUMA	MA	48	132.63	REST.TANZ.	MA	219	134.37	0.8689	X	X
NYAKYUSA	MA	78	131.06	REST.TANZ.	MA	189	135.21	0.6892	X	X
KINGA	MA	18	123.31	REST.TANZ.	MA	249	134.77	0.5429	X	X
HEHE	MA	112	73.87	HEHE	FA	62	112.12	0.0000	✓	✓
HEHE	MA	112	62.32	HEHE	MJ	31	106.97	0.0000	✓	✓
HEHE	FA	62	42.82	HEHE	FJ	31	55.35	0.0348	✓	X
HEHE	MJ	31	31.29	HEHE	FJ	31	31.71	0.9271	X	X
TUTSI	MA	11	11.73	TUTSI	FA	13	13.15	0.6490	X	X
TUTSI	MA	11	8.18	TUTSI	MJ	7	11.57	0.2109	X	X
TUTSI	FA	13	9.08	TUTSI	FJ	4	8.75	0.9563	X	X
TUTSI	MJ	7	6.71	TUTSI	FJ	4	4.75	0.4121	X	X
HEHE	MA	112	61.72	TUTSI	MA	11	64.82	0.7853	X	X
HEHE	FA	62	39.61	TUTSI	FA	13	30.31	0.1616	X	X
HEHE	MA	112	81.46	SUKUMA	MA	48	78.26	0.6889	X	X
HEHE	MA	112	97.69	NYAKYUSA	MA	78	92.36	0.5112	X	X
HEHE	MA	112	66.39	KINGA	MA	18	59.94	0.5002	X	X
TUTSI	MA	11	31.23	SUKUMA	MA	48	29.72	0.7927	X	X
TUTSI	MA	11	47.45	NYAKYUSA	MA	78	44.65	0.7364	X	X
TUTSI	MA	11	15.82	KINGA	MA	18	14.50	0.7071	X	X
SUKUMA	MA	48	63.72	NYAKYUSA	MA	78	63.37	0.9579	X	X
SUKUMA	MA	48	34.14	KINGA	MA	18	31.81	0.6605	X	X
KINGA	MA	18	45.56	NYAKYUSA	MA	78	49.18	0.6188	X	X

Table A3.60 - Nasal Bridge Distance Lateral Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	371	266.67	ALL	FA	153	252.39	0.3263	X	X
TANZANIA	MA	266	212.07	G.B.	MA	98	102.25	0.0000	✓	✓
TANZANIA	FA	82	97.97	G.B.	FA	70	51.56	0.0000	✓	✓
G.B.	MA	98	82.68	G.B.	FA	70	87.05	0.5658	X	X
N.E.G.B.	MA	35	51.86	REST.G.B.	MA	63	48.17	0.5358	X	X
N.E.G.B.	FA	19	52.45	REST.G.B.	FA	51	28.06	1.5468	X	X
N.E.G.B.	MA	35	27.51	N.E.G.B.	FA	19	27.47	0.9928	X	X
REST. G.B	MA	63	55.35	REST.G.B.	FA	51	60.16	0.4400	X	X
TANZANIA	MA	266	170.91	TANZANIA	FA	82	186.15	0.2305	X	X
TANZANIA	MA	266	147.82	TANZANIA	MJ	38	185.26	0.0140	✓	X
TANZANIA	FA	82	56.97	TANZANIA	FJ	35	63.76	0.3216	X	X
TANZANIA	MJ	38	37.88	TANZANIA	FJ	35	36.04	0.7114	X	X
HEHE	MA	111	145.81	REST.TANZ	MA	155	124.26	0.0723	X	X
TUTSI	MA	11	92.73	REST.TANZ	MA	255	135.26	0.0276	X	X
SUKUMA	MA	48	130.90	REST.TANZ	MA	218	134.07	0.7956	X	X
NYAKYUSA	MA	78	127.66	REST.TANZ	MA	188	135.92	0.4252	X	X
KINGA	MA	18	114.78	REST.TANZ	MA	248	134.86	0.2849	X	X
HEHE	MA	111	85.99	HEHE	FA	62	88.81	0.7229	X	X
HEHE	MA	111	68.75	HEHE	MJ	31	81.34	0.1320	X	X
HEHE	FA	62	45.03	HEHE	FJ	31	50.94	0.3201	X	X
HEHE	MJ	31	32.06	HEHE	FJ	31	30.94	0.8054	X	X
TUTSI	MA	11	11.55	TUTSI	FA	13	13.31	0.5691	X	X
TUTSI	MA	11	8.64	TUTSI	MJ	7	10.86	0.4252	X	X
TUTSI	FA	13	9.31	TUTSI	FJ	4	8.00	0.7034	X	X
TUTSI	MJ	7	6.71	TUTSI	FJ	4	4.75	0.4121	X	X
HEHE	MA	111	63.70	TUTSI	MA	11	39.32	0.0292	✓	X
HEHE	FA	62	39.25	TUTSI	FA	13	32.04	0.2780	X	X
HEHE	MA	111	82.83	SUKUMA	MA	48	73.46	0.2388	X	X
HEHE	MA	111	100.43	NYAKYUSA	MA	78	87.28	0.1037	X	X
HEHE	MA	111	66.85	KINGA	MA	18	53.28	0.1625	X	X
TUTSI	MA	11	22.64	SUKUMA	MA	48	31.69	0.1149	X	X
TUTSI	MA	11	34.41	NYAKYUSA	MA	78	46.49	0.1464	X	X
TUTSI	MA	11	14.36	KINGA	MA	18	15.39	0.7739	X	X
SUKUMA	MA	48	64.38	NYAKYUSA	MA	78	62.96	0.8329	X	X
SUKUMA	MA	48	34.88	KINGA	MA	18	29.83	0.3420	X	X
KINGA	MA	18	44.47	NYAKYUSA	MA	78	49.43	0.4961	X	X

Table A3.61 - General Facial Size Factor Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	286	249.85	ALL	FA	127	110.51	0.0000	✓	✓
TANZANIA	MA	188	168.11	G.B.	MA	98	96.29	0.0000	✓	✓
TANZANIA	FA	57	83.36	G.B.	FA	70	48.24	0.0000	✓	✓
G.B.	MA	98	112.99	G.B.	FA	70	44.61	0.0000	✓	✓
N.E.G.B.	MA	35	38.19	REST G.B.	MA	63	55.79	0.0033	✓	✓
N.E.G.B.	FA	19	34.39	REST G.B.	FA	51	35.91	0.7814	X	X
N.E.G.B.	MA	35	33.80	N.E.G.B.	FA	19	15.89	0.0001	✓	✓
REST G.B.	MA	63	80.25	REST G.B.	FA	51	29.40	0.0000	✓	✓
TANZANIA	MA	188	138.85	TANZANIA	FA	57	67.41	0.0000	✓	✓
TANZANIA	MA	188	127.80	TANZANIA	MJ	37	37.81	0.0000	✓	✓
TANZANIA	FA	57	51.00	TANZANIA	FJ	32	34.31	0.0034	✓	✓
TANZANIA	MJ	37	34.47	TANZANIA	FJ	32	35.61	0.8144	X	X
HEHE	MA	65	50.50	REST.TANZ.	MA	123	117.75	0.0000	✓	✓
TUTSI	MA	10	21.40	REST.TANZ.	MA	178	98.61	0.0000	✓	✓
SUKUMA	MA	48	113.76	REST.TANZ.	MA	140	87.90	0.0045	✓	✓
NYAKYUSA	MA	64	137.49	REST.TANZ.	MA	124	72.31	0.0000	✓	✓
HEHE	MA	65	56.10	HEHE	FA	44	53.38	0.6587	X	X
HEHE	MA	65	54.32	HEHE	MJ	28	30.00	0.0001	✓	✓
HEHE	FA	44	43.20	HEHE	FJ	28	25.96	0.0007	✓	✓
HEHE	MJ	28	28.34	HEHE	FJ	28	28.66	0.9412	X	X
TUTSI	MA	10	13.80	TUTSI	FA	13	10.62	0.2839	X	X
TUTSI	MA	10	11.50	TUTSI	MJ	7	5.43	0.0132	✓	X
TUTSI	FA	13	11.00	TUTSI	FJ	4	2.50	0.0008	✓	✓
TUTSI	MJ	7	7.57	TUTSI	FJ	4	3.25	0.0372	✓	X
HEHE	MA	65	40.88	TUTSI	MA	10	19.30	0.0036	✓	✓
HEHE	FA	44	33.19	TUTSI	FA	13	14.81	0.0004	✓	✓
HEHE	MA	65	39.33	SUKUMA	MA	48	80.93	0.0000	✓	✓
HEHE	MA	65	35.36	NYAKYUSA	MA	64	95.10	0.0000	✓	✓
TUTSI	MA	10	7.00	SUKUMA	MA	48	34.19	0.0000	✓	✓
TUTSI	MA	10	5.50	NYAKYUSA	MA	64	42.50	0.0000	✓	✓
SUKUMA	MA	48	46.65	NYAKYUSA	MA	64	63.89	0.0054	✓	✓

Table A3.62 - Nasal Bridge Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	286	202.45	ALL	FA	127	217.24	0.2455	X	X
TANZANIA	MA	188	116.15	G.B.	MA	98	195.96	0.0000	√	√
TANZANIA	FA	57	47.06	G.B.	FA	70	77.79	0.0000	√	√
G.B.	MA	98	87.24	G.B.	FA	70	80.66	0.3877	X	X
N.E.G.B.	MA	35	44.74	REST G.B.	MA	63	52.14	0.2170	X	X
N.E.G.B.	FA	19	33.76	REST G.B.	FA	51	36.15	0.6630	X	X
N.E.G.B.	MA	35	27.71	N.E.G.B.	FA	19	27.11	0.8919	X	X
REST G.B.	MA	63	60.90	REST G.B.	FA	51	53.29	0.2216	X	X
TANZANIA	MA	188	123.51	TANZANIA	FA	57	121.32	0.8385	X	X
TANZANIA	MA	188	118.46	TANZANIA	MJ	37	85.26	0.0046	√	√
TANZANIA	FA	57	48.30	TANZANIA	FJ	32	29.13	0.1080	X	X
TANZANIA	MJ	37	33.89	TANZANIA	FJ	32	36.28	0.6218	X	X
HEHE	MA	65	78.91	REST.TANZ.	MA	123	102.74	0.0043	√	√
TUTSI	MA	10	133.50	REST.TANZ.	MA	178	92.31	0.0198	√	X
SUKUMA	MA	48	101.59	REST.TANZ.	MA	140	92.07	0.2953	X	X
NYAKYUSA	MA	64	98.15	REST.TANZ.	MA	124	92.62	0.5090	X	X
HEHE	MA	65	52.53	HEHE	FA	44	58.65	0.3216	X	X
HEHE	MA	65	49.48	HEHE	MJ	28	41.23	0.1762	X	X
HEHE	FA	44	40.07	HEHE	FJ	28	30.89	0.0698	X	X
HEHE	MJ	28	27.25	HEHE	FJ	28	29.75	0.5663	X	X
TUTSI	MA	10	13.10	TUTSI	FA	13	11.15	0.5224	X	X
TUTSI	MA	10	10.10	TUTSI	MJ	7	7.43	0.3148	X	X
TUTSI	FA	13	8.77	TUTSI	FJ	4	9.75	0.7849	X	X
TUTSI	MJ	7	5.29	TUTSI	FJ	4	7.25	0.3447	X	X
HEHE	MA	65	35.34	TUTSI	MA	10	55.30	0.0070	√	√
HEHE	FA	44	27.93	TUTSI	FA	13	32.62	0.3714	X	X
HEHE	MA	65	51.14	SUKUMA	MA	48	64.94	0.0269	√	X
HEHE	MA	65	58.23	NYAKYUSA	MA	64	71.88	0.0382	√	X
TUTSI	MA	10	38.40	SUKUMA	MA	48	27.65	0.0699	X	X
TUTSI	MA	10	50.40	NYAKYUSA	MA	64	35.48	0.0414	√	X
SUKUMA	MA	48	57.76	NYAKYUSA	MA	64	55.55	0.7221	X	X

Table A3.63 - Nasal Prominence Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	286	209.69	ALL	FA	127	200.93	0.4913	X	X
TANZANIA	MA	188	101.47	G.B.	MA	98	224.31	0.0000	✓	✓
TANZANIA	FA	57	32.18	G.B.	FA	70	89.91	0.0000	✓	✓
G.B.	MA	98	93.42	G.B.	FA	70	72.01	0.0049	✓	✓
N.E.G.B.	MA	35	50.54	REST G.B.	MA	63	48.92	0.7867	X	X
N.E.G.B.	FA	19	30.21	REST G.B.	FA	51	37.47	0.1844	X	X
N.E.G.B.	MA	35	30.80	N.E.G.B.	FA	19	21.42	0.0364	✓	X
REST G.B.	MA	63	62.99	REST G.B.	FA	51	50.72	0.0486	✓	X
TANZANIA	MA	188	134.16	TANZANIA	FA	57	86.19	0.0000	✓	✓
TANZANIA	MA	188	124.61	TANZANIA	MJ	37	54.00	0.0000	✓	✓
TANZANIA	FA	57	48.87	TANZANIA	FJ	32	38.11	0.0594	X	X
TANZANIA	MJ	37	34.28	TANZANIA	FJ	32	35.83	0.7498	X	X
HEHE	MA	65	79.95	REST.TANZ	MA	123	102.19	0.0077	✓	✓
TUTSI	MA	10	101.20	REST.TANZ	MA	178	94.12	0.6890	X	X
SUKUMA	MA	48	106.09	REST.TANZ	MA	140	90.52	0.0872	X	X
NYAKYUSA	MA	64	99.16	REST.TANZ	MA	124	92.10	0.3993	X	X
HEHE	MA	65	61.61	HEHE	FA	44	45.24	0.0080	✓	✓
HEHE	MA	65	54.82	HEHE	MJ	28	28.84	0.0000	✓	✓
HEHE	FA	44	40.22	HEHE	FJ	28	30.66	0.0589	X	X
HEHE	MJ	28	27.96	HEHE	FJ	28	20.04	0.8058	X	X
TUTSI	MA	10	12.90	TUTSI	FA	13	11.31	0.6049	X	X
TUTSI	MA	10	10.40	TUTSI	MJ	7	7.00	0.1932	X	X
TUTSI	FA	13	8.92	TUTSI	FJ	4	9.25	0.9563	X	X
TUTSI	MJ	7	5.43	TUTSI	FJ	4	7.00	0.4497	X	X
HEHE	MA	65	36.98	TUTSI	MA	10	44.60	0.3036	X	X
HEHE	FA	44	26.86	TUTSI	FA	13	36.33	0.0738	X	X
HEHE	MA	65	50.49	SUKUMA	MA	48	65.81	0.0140	✓	X
HEHE	MA	65	58.22	NYAKYUSA	MA	64	71.88	0.0380	✓	X
TUTSI	MA	10	28.20	SUKUMA	MA	48	29.77	0.7890	X	X
TUTSI	MA	10	39.00	NYAKYUSA	MA	64	37.27	0.8125	X	X
SUKUMA	MA	48	59.03	NYAKYUSA	MA	64	54.60	0.4750	X	X

Table A3.64 - Nasal Index

POP.	CAT	n	MEAN RK	POP.	CAT	n	MEAN RK	PROB.	SIG. 5%	SIG. 1%
ALL	MA	288	197.21	ALL	FA	128	233.91	0.0041	✓	✓
TANZANIA	MA	189	97.03	G.B.	MA	99	235.02	0.0000	✓	✓
TANZANIA	FA	58	32.72	G.B.	FA	70	90.03	0.0000	✓	✓
G.B.	MA	99	84.68	G.B.	FA	70	85.45	0.9199	X	X
N.E.G.B.	MA	35	46.36	REST G.B.	MA	64	51.00	0.3506	X	X
N.E.G.B.	FA	19	34.68	REST G.B.	FA	51	35.80	0.8378	X	X
N.E.G.B.	MA	35	26.90	N.E.G.B.	FA	19	28.61	0.7036	X	X
REST G.B.	MA	64	58.84	REST G.B.	FA	51	56.94	0.7611	X	X
TANZANIA	MA	189	125.17	TANZANIA	FA	58	120.17	0.6409	X	X
TANZANIA	MA	189	115.07	TANZANIA	MJ	37	105.49	0.4149	X	X
TANZANIA	FA	58	46.71	TANZANIA	FJ	32	43.31	0.5551	X	X
TANZANIA	MJ	37	35.53	TANZANIA	FJ	32	34.39	0.8145	X	X
HEHE	MA	66	72.80	REST.TANZ.	MA	123	106.91	0.0000	✓	✓
TUTSI	MA	10	130.80	REST.TANZ.	MA	179	93.00	0.0334	✓	X
SUKUMA	MA	48	106.13	REST.TANZ.	MA	141	91.21	0.1028	X	X
NYAKYUSA	MA	64	102.74	REST.TANZ.	MA	125	91.04	0.1638	X	X
HEHE	MA	66	55.41	HEHE	FA	45	56.87	0.8148	X	X
HEHE	MA	66	47.34	HEHE	MJ	28	47.88	0.9308	X	X
HEHE	FA	45	36.57	HEHE	FJ	28	37.70	0.8249	X	X
HEHE	MJ	28	28.02	HEHE	FJ	28	28.98	0.8264	X	X
TUTSI	MA	10	10.50	TUTSI	FA	13	13.15	0.3758	X	X
TUTSI	MA	10	9.45	TUTSI	MJ	7	8.36	0.6691	X	X
TUTSI	FA	13	9.77	TUTSI	FJ	4	6.50	0.2958	X	X
TUTSI	MJ	7	5.71	TUTSI	FJ	4	6.50	0.7055	X	X
HEHE	MA	66	35.71	TUTSI	MA	10	56.90	0.0047	✓	✓
HEHE	FA	45	24.20	TUTSI	FA	13	47.85	0.0000	✓	✓
HEHE	MA	66	48.97	SUKUMA	MA	48	69.23	0.0012	✓	✓
HEHE	MA	66	55.07	NYAKYUSA	MA	64	76.26	0.0013	✓	✓
TUTSI	MA	10	36.50	SUKUMA	MA	48	28.04	0.1495	X	X
TUTSI	MA	10	48.20	NYAKYUSA	MA	64	35.83	0.0905	X	X
SUKUMA	MA	48	57.73	NYAKYUSA	MA	64	55.58	0.7286	X	X

APPENDIX 4 - DISCRIMINANT FUNCTION ANALYSIS RESULTS

Table A4.1(a) - Standardized Discriminant Function Coefficients

POPULATIONS : - Tanzania MA, Tanzania FA, G.B. MA, G.B. FA.

VARIABLE	FUNCTION 1	FUNCTION 2	FUNCTION 3
Nasal Prom. Index	1.65997*	-1.47228	-1.11341
Chin Angle	0.33608*	-0.20868	-0.13770
Upper Lip Angle	-0.30931*	0.18671	0.06318
Eye Fissure Index	0.29154*	0.08672	-0.10319
Bioccular Wth.Index	0.26985*	-0.15157	0.26512
Lower Fce-Frhd.Ht. Index	-0.18933*	-0.15893	0.11054
Labial Protr/Retr.	0.17673*	-0.03946	0.15936
General Facial Size Factor	0.25773	-7.97679*	-1.64032
Height of Face	0.58211	5.92442*	0.57228
Mouth Width	-0.43024	-1.87967*	-0.66553
Lat.Prop.Index III	-0.31754	1.72318*	0.09743
Mouth-Nose Wth.Index	0.13501	1.71420*	0.90016
Nas.Brid.Lat.Index	-0.87087	-1.14993*	0.28348
Nas.Prom.Lat.Index	0.17835	1.04140*	0.63175
Nas.Prom.Brid.Index	0.70582	1.01542*	-0.15200
Lower Lip Height	-0.18417	0.89860*	0.44485
Lat.Prop.Index II	-0.10752	-0.86343*	0.14920
Occular Index	0.45574	-0.53124*	0.16559
Inter-occular Dist.	0.35402	-0.42988*	0.22999
Lip Index	-0.32238	0.40019*	0.27812
Left Eye Fiss.Ht.	0.21911	0.36394*	0.00323
Columella Length	-0.24676	-0.33886*	0.30488
Col.Lnth.Vert.Index	-0.29502	-0.30792*	0.16728
Mandibular Pro/Retr.	-0.00111	0.18211*	0.02006
Biaural Breadth	-0.15025	2.46598	7.47075*
Bizygomatic Diam.	-0.28965	0.75017	-5.81071*
Ear Protrusion Index	-0.02826	1.85228	4.36641*
Nasal Prominence	-1.88225	2.24000	2.64445*
Nasal Breadth Index	0.50270	-1.45634	-1.71738*
Nasal Breadth	0.36067	-0.05619	-1.47271*
Total Lip Height	-0.13546	-0.87045	-1.02755*
Mouth Index	0.14103	-0.20928	-0.48323*
Ht. of Upper Face	0.01587	-0.16361	-0.31238*
Left Eye Fiss.Width	-0.07880	-0.16789	0.19811*
Nasal Wing/Sept.Rel.	0.06559	0.01110	-0.18447*
Lower Face Prop.Ind.	-0.09759	0.00878	0.17893*

Table A4.1(b) - F Statistics and Significances between pairs of groups

(Each F Statistic has 36 and 314 degrees of freedom)

GROUP	1	2	3
2	5.6129 0.0000		
3	70.611 0.0000	53.107 0.0000	
4	33.328 0.0000	29.844 0.0000	5.2416 0.0000

GROUP 1 = GB. MA
GROUP 2 = GB. FA
GROUP 3 = TANZ. MA
GROUP 4 = TANZ. FA

Table A4.1(c) - Canonical Discriminant Functions

FUNCTION	EIGEN VALUE	PERCENT OF VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION
1*	11.54418	90.64	90.64	0.9593152
2*	0.70734	5.55	96.19	0.6436554
3*	0.48524	3.81	100.00	0.5715827

Table A4.1(d)

AFTER FUNCTION	WILKS' LAMBDA	CHI-SQUARED	DF	SIGNIFICANCE
0	0.314371	1148.6	108	0.0000
1	0.3943530	308.93	70	0.0000
2	0.6732932	131.33	34	0.0000

Table A4.1(e) - Canonical Discriminant Functions Evaluated at Group Means (Group Centroids)

GROUP	FUNCTION 1	FUNCTION 2	FUNCTION 3
1	3.39184	-1.07937	1.96333
2	4.59466	-1.51917	-0.39319
3	-2.75312	0.38533	-0.70012
4	-1.47349	2.47154	-1.04860

Table A4.1(f) - Test of Equality of Group Covariance Matrices

Box's M	Approx. F	Degrees of Freedom		Significance
1370.8	1.3788	666	27569.6	0.0000

Table A4.2(a) - Standardized Discriminant Function Coefficients

POPULATIONS:- HEHE MA, TUTSI MA, SUKUMA MA, and NYAKYUSA MA

VARIABLE	FUNCTION 1	FUNCTION 2	FUNCTION 3
Biocular Diameter	-2.96629*	-0.26066	1.66977
Biocular Width Index	-1.95855*	-0.06442	1.06517
Auricle Chin Distance	-0.89832*	0.12861	-0.38419
Eye Fissure Index	0.72578*	0.72557	-0.33814
Chin Angle	0.60922*	-0.05800	0.54920
Lower Face-Frhd. Ht. Index	0.44219*	0.14099	0.33423
Mouth Index	0.26562*	-0.06794	0.02477
Height of Upper Face	0.21149	1.12360*	0.93427
Left Eye Fissure Height	0.29042	0.97488*	0.06477
Upper Face-Frhd.Ht. Index	-0.15673	-0.86929*	-0.74459
Left Eye Fissure Width	-0.33333	-0.65605*	0.05973
Nasal Angle	-0.04051	-0.48917*	-0.06677
Nasal Prom.Lateral Index	-0.10293	-0.28807*	0.04340
Columella Length	0.18748	-0.24145*	-0.04441
Nasal Wing/Septum Rel.	0.13974	-0.18599*	-0.07629
Biaural Breadth	0.50783	-0.04891	10.91393*
Bizygomatic Diameter	1.18035	-1.44589	-8.25460*
Ear Protrusion Index	0.28458	-0.30040	7.87660*
Nasal Breadth	0.98711	1.51848	-6.25086*
Nasal Breadth Index	0.91689	1.77464	-5.67851*
Whole Upper Lip Vert. Index	0.49955	0.91020	1.59462*
Nasal Height	-0.14422	-1.05838	-1.08283*
Height of Whole Upper Lip	0.73712	0.89571	1.02189*
Lateral Proportion Index I	-0.20520	0.06693	-0.41591*
Right Eye Fissure Width	-0.01729	-0.26942	-0.41037*

Table A4.2(b) - F Statistics and Significances between pairs of groups

(Each F statistic has 25 and 142 degrees of freedom)

GROUP	1	2	3
2	1.6610 0.0346		
3	10.029 0.0000	2.6817 0.0001	
4	13.348 0.0000	3.2882 0.0000	3.8942 0.0000

GROUP 1 = HEHE MA
GROUP 2 = TUTSI MA
GROUP 3 = SUKUMA MA
GROUP 4 = NYAKYUSA MA

Table A4.2(c) - Canonical Discriminant Functions

FUNCTION	EIGEN VALUE	PERCENT of VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION
1*	2.71191	74.22	74.22	0.8547496
2*	0.67787	18.55	92.77	0.6356157
3*	0.26430	7.23	100.00	0.4572176

Table A4.2(d)

AFTER FUNCTION	WILKS' LAMBDA	CHI-SQUARED	DF.	SIGNIFICANCE
0	0.1269971	318.82	75	0.0000
1	0.4714017	116.19	48	0.0000
2	0.7909521	36.233	23	0.0390

Table A4.2(e) - Canonical Discriminant Functions Evaluated as Group Means (Group Centroids)

GROUP	FUNCTION 1	FUNCTION 2	FUNCTION 3
1	2.01865	-0.47331	-0.54958
2	1.94219	2.23313	-3.66211
3	-0.58779	1.13608	0.83100
4	-1.53681	-0.52650	0.06137

Table A4.2(f) - Test of Equality of Group Convariance Matrices

Box's M	Approx. F.	Degrees of Freedom		Significance
1.313.8	1.5751	650	62813.8	0.0000

Table A4.3(a) - Standardized Discriminant Function Coefficients

Populations:- Hehe Ma, Kinga Ma, Nyakyusa Ma, Sukuma Ma and Tutsi Ma.

VARIABLES	FUNCTION 1	FUNCTION 2	FUNCTION 3	FUNCTION 4
Eye Fissure Index	-0.67041*	0.01072	0.06473	-0.13472
Upper Face-Frhd.Ht.Index	-0.55650*	0.45365	-0.05128	-0.18189
Biocular-Mouth Width Index	-0.49205*	-0.27425	0.09984	0.23109
Nasal Base Angle	0.41436*	0.19861	-0.35584	-0.04110
Lip Index	-0.41213*	-0.10071	-0.01896	0.01916
Mouth-Nose Width Index	-0.26582	-0.85255*	0.27214	-0.07584
Chin Angle	-0.02402	0.71422*	0.62157	0.27062
Nasal Angle	0.31810	0.62827*	-0.35025	-0.54423
Mouth Index	-0.21430	0.35355*	0.03382	-0.16712
Ear Protrusion Index	0.11343	0.00332	-0.74264*	-0.18793
Upper-Lower Facial Ht.Index	0.53057	-0.13558	0.70473*	-0.36223
Whole Upper Lip Vert.Index	0.47046	0.06198	0.35641	2.25417*
Lower Face Prop. Index	-0.01453	0.04382	-0.11624	-1.70023*
Lower Facial Ht. Vert.Index	0.57797	-0.01374	0.85520	1.33699*
Lateral Prop. Index I	0.12179	-0.75048	-0.54762	-0.77758*
Frontal Recession Angle	0.04272	0.04691	-0.00233	-0.66616*
Lateral Prop Index II	0.26519	0.44879	-0.02474	0.51867*
Frontal Protr/Retraction	0.01998	0.05933	0.02971	0.38564*

Table A4.3(b) - F Statistics and Significances between Pairs of Groups

(Each F Statistic has 18 and 217 Degrees of Freedom)

GROUP	1	2	3	4
2	3.2758 0.0000			
3	7.4056 0.0000	2.3048 0.0026		
4	7.8023 0.0000	2.7385 0.0003	2.9791 0.0001	
5	1.5479 0.0760	2.1100 0.0065	1.5724 0.0689	1.4482 0.1115

GROUP 1 = Hehe MA
GROUP 2 = Kinga MA
GROUP 3 = Nyakyusa MA
GROUP 4 = Sukuma MA
GROUP 5 = Tutsi MA

Table A4.3(c) - Canonical Discriminant Functions

FUNCTION	EIGEN VALUE	PERCENT of VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION
1*	0.81837	59.93	59.93	0.6708631
2*	0.26172	19.16	79.09	0.4554431
3*	0.20342	14.90	93.99	0.4111373
4*	0.08210	6.01	100.00	0.2754484

Table A4.3(d)

AFTER FUNCTION	WILKS' LAMBDA	CHI-SQUARED	DF.	SIGNIFICANCE
0	0.3347121	247.90	72	0.0000
1	0.6086309	112.47	51	0.0000
2	0.7679192	59.812	32	0.0020
3	0.9241282	17.872	15	0.2695

Table A4.3(e) - Canonical Discriminant Functions Evaluated at Group Means (Group Centroids)

GROUP	FUNCTION 1	FUNCTION 2	FUNCTION 3	FUNCTION 4
1	-0.76056	0.56052	0.41419	-0.09392
2	0.54240	0.51021	-0.36748	1.42220
3	0.37542	-0.27932	-0.76974	-0.18897
4	0.95739	-0.77232	0.41560	-0.00007
5	-1.67508	-2.50874	0.37238	0.14476

Table A4.3(f) - Test of Equality of Group Covariance Matrices

Box's M.	Approx. F.	Degrees of Freedom		Significance
809.34	2.0551	342	60658.3	0.0000

Table A4.4(a) - Standardized Discriminant Function Coefficients

Populations:- Hehe MA, FA, MJ and FJ.

VARIABLES	FUNCTION 1	FUNCTION 2	FUNCTION 3
Lower Face Frhd. Ht.Index	-0.56998*	-0.17693	-0.13013
Eye Fissure Index	-0.45142*	-0.34706	-0.09874
Upper-Lower Facial Ht.Index	0.39794*	-0.09801	0.03256
Mandibular Protr/Retr.	0.37788*	-0.11212	0.17710
Labial Protr/Retraction	-0.21694*	0.04583	0.20253
Ear Protrusion Index	0.03164	0.82752*	0.00843
Lateral Prop.Index I	0.29889	0.63048*	0.11091
Upper Lip Angle	0.07398	-0.43867*	0.16494
Nasal Prom. Lat. Index	0.22452	-0.35106	-1.28194*
Nasal Ht.-Prom. Index	0.32100	0.43174	0.93415*
Lower Facial Ht.Vert Index	0.76468	0.07431	0.92947*
Frontal Recession Angle	-0.04478	-0.01111	-0.54836*
Nasal Col. Length Index	0.13545	0.03470	0.46660*
Nasal Wing/Septum Rel.	-0.10434	0.11831	-0.38711*
Nasal Breadth Index	0.18861	-0.29787	-0.32761*

Table A4.4(b) - F Statistics and Significances between Pairs of Groups

(Each F Statistic has 15 and 194 Degrees of Freedom)

GROUP	1	2	3	
2	4.5955 0.0000			GROUP 1 = Hehe MA GROUP 2 = Hehe FA GROUP 3 = Hehe MJ GROUP 4 = Hehe FJ
3	5.2597 0.0000	3.1671 0.0001		
4	8.7498 0.0000	4.7351 0.0000	1.7074 0.0520	

Table A4.4(c) - Canonical Discriminant Functions

FUNCTION	EIGEN	PERCENT of VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION
1*	0.83172	69.69	69.69	0.6738440
2*	0.25522	21.39	91.08	0.4509209
3*	0.10647	8.92	100.00	0.3102050

Table A4.4(d)

AFTER FUNCTION	WILKS' LAMBDA	CHI-SQUARED	DF.	SIGNIFICANCE
0	0.3930776	188.15	45	0.0000
1	0.7200090	66.191	28	0.0001
2	0.9037729	20.387	13	0.0860

Table A4.4(e) - Canonical Discriminant Functions Evaluated at Group Means (Group Centroids)

GROUP	FUNCTION 1	FUNCTION 2	FUNCTION 3
1	-0.67447	0.11293	0.51843
2	0.34599	0.71340	-0.30675
3	0.23975	-0.80518	-0.96083
4	1.43810	-0.96499	-0.27822

Table A4.5(a) - Standardized Discriminant Function Coefficients

Populations:- NEGB. MA, NEGB FA, RGB MA, and RGB FA.

VARIABLES	FUNCTION 1	FUNCTION 2	FUNCTION 3
Auricle-Chin Distance	0.95370*	0.33197	0.12638
Biaural Breadth	0.57798*	-0.01969	0.18774
Chin Angle	-0.38981*	-0.19016	-0.02307
Inter-Occular Distance	-0.22717	-5.40870*	0.16446
Inter-Occular -Nasal Wth.Index	-0.45279	4.26769*	0.44161
Nasal Breadth	-0.01239	2.38121*	-1.88016
Upper Face-Frhd. Ht. Index	0.74545	1.82645*	0.25504
Height of Forehead	0.55646	1.66010*	0.24333
Columella Length	0.44827	1.48242*	0.94761
Nasal Columella Length Index	0.10845	1.21115*	1.19079
Inter-Occular Width Index	-0.44122	-0.89746*	0.31607
Right Eye Fissure Width	-0.09764	0.82007*	-0.10732
Left Eye Fissure Width	0.12732	-0.52254*	0.19166
Lateral Prop. Index II	0.19645	-0.39997*	-0.20044
Nasal Wing/Septum Rel.	-0.19822	0.36058*	-0.07701
Nasal Index	0.05552	-0.50901	-3.15741*
Nasal Ht. Prom. Index	0.02557	-0.29955	2.87778*
Nasal Prom. Index	0.05123	-0.46681	2.34096*
Vert. Ht. of Lower Face	-0.46906	-0.42940	1.07513*
Nasal Base Angle	-0.09537	0.11092	0.82711*
Upper-Lower Facial Ht. Index	-0.60114	-0.54911	0.65983*
Bioccular-Mouth Width Index	0.13548	-0.06726	-0.53795*
Nasal Angle	-0.01731	0.05230	0.47705*
Upper Lip Angle	0.09031	0.27994	0.39756*
Upper Lip Height	0.06440	0.21612	-0.39495*

Table A4.5(b) - F Statistics and Significances between Pairs of Groups

(Each F Statistic has 25 and 112 Degrees of Freedom)

GROUP	1	2	3
2	2.0420 0.0061		
3	4.0381 0.0000	4.1118 0.0000	
4	4.8433 0.0000	2.3476 0.0013	5.4804 0.0000

GROUP 1 = NEGB. MA
GROUP 2 = NEGB. FA
GROUP 3 = RGB. MA
GROUP 4 = RGB. FA

Table A4.5(c) - Canonical Discriminant Functions

FUNCTION	EIGEN VALUE	PERCENT of VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION
1*	1.40139	51.36	51.36	0.7639399
2*	1.01739	37.29	88.65	0.7101478
3*	0.30968	11.35	100.00	0.4862645

Table A4.5(d)

AFTER FUNCTION	WILKS' LAMBDA	CHI-SQUARED	DF.	SIGNIFICANCE
0	0.1576101	230.03	75	0.0000
1	0.3784826	120.96	48	0.0000
2	0.7635468	33.588	23	0.0714

Table A4.5(e) - Canonical Discriminant Functions Evaluated at Group Means (Group Centroids)

GROUP	FUNCTION 1	FUNCTION 2	FUNCTION 3
1	0.36839	-1.42841	0.59469
2	-1.72713	-0.37122	1.30328
3	0.98485	0.82013	0.02744
4	-1.41692	0.10931	-1.27565

Table A4.5(f) - Test of Equality of Group Covariance Matrices

Box's M.	Approx. F.	Degrees of Freedom		Significance
1648.3	1.6905	650	24346.4	0.0

Table A4.6(a) - F Statistics and Significances between Pairs of Groups
(Each F Statistic has 15 and 270 Degrees of Freedom)

GROUP	1
2	16.371 0.0000

GROUP 1 = Hehe FA
Group 2 = Tutsi FA

Table A4.6(b) - Canonical Discriminant Functions

FUNCTIONS = 1*
EIGEN VALUE = 9.09489
PERCENT OF VARIANCE = 100%
CANONICAL CORRELATION = 0.9491786

Table A4.6(c)

AFTER FUNCTION= 0
WILKS' LAMBDA = 0.0990600
X^2 = 77.453
D.F. = 15
SIGNIFICANCE = 0.0000

Table A4.6(d) - Canonical Discriminant Functions Evaluated at Group Means (Group Centroids)

GROUP	FUNCTION 1
1	-1.06819
2	8.11827

APPENDIX 5 - FACTOR ANALYSIS

Table A5.1 - Factor Analysis - Distance Measurements, Angles and Relationships

VARIABLES	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
Nasal Breadth	0.73171	-0.38267	0.07963	0.23361	-0.10122
Bizygomatic Diam.	0.95132	-0.01108	-0.00842	0.11933	0.00469
Biaural Breadth	0.90985	0.13072	-0.05891	0.00552	0.01636
Inter-Occ.Dist.	0.71481	-0.18804	0.05223	0.12694	-0.02442
Bioccular Diam.	0.90177	-0.15882	0.02707	0.15185	-0.04127
Mouth Width	0.76514	-0.21595	0.03821	0.22103	-0.05431
Upper Lip Height	0.40586	-0.04809	0.07448	0.23628	-0.09371
Lower Lip Height	0.52887	-0.72232	0.09293	0.09503	-0.07611
Orbit-Aur.Dist.	0.80567	-0.14770	0.02708	0.10134	0.06696
Total Ht.of Lips	0.49163	-0.74099	0.08826	0.18386	-0.08704
Rt.Eye Fiss. Wth.	0.80606	-0.02823	-0.00297	0.11051	-0.00351
Lft.Eye Fiss.Wth.	0.83356	-0.02629	-0.04780	0.08193	-0.00328
Rt.Eye Fiss.Ht.	0.59808	-0.19808	0.01589	0.09247	-0.01425
Lt.Eye Fiss.Ht.	0.61111	-0.21435	-0.00070	0.09991	0.00680
Height of Face	0.83818	-0.03424	-0.01628	-0.08325	0.09807
Auricle-Chin Dist	0.81828	-0.16613	0.06414	0.30477	0.09770
Nasal Prom.	0.54004	0.18772	-0.14364	-0.02245	0.24449
Nasal Bridge Dist	0.30649	0.15405	-0.09763	-0.05060	0.80699
Nasal Height	0.70473	0.11349	-0.37676	-0.18554	0.17044
Ht.Whole Upp.Lip	0.66150	-0.13571	0.26600	-0.01196	0.08270
Columella Length	0.42464	0.06860	-0.17470	-0.07455	0.09786
Nasal Angle	-0.17476	0.24011	-0.18380	-0.64227	0.11119
Nasal Base Angle	0.20039	-0.32576	0.13305	0.64067	-0.17207
Nasal Wing/Sept.	-0.05125	0.16891	0.05405	-0.02050	-0.00250
Upper Lip Angle	0.09425	-0.55475	0.17226	0.55893	-0.09369
Chin Angle	0.01636	0.07100	0.29417	0.56664	-0.01174
Front.Rec.Angle	-0.23795	0.10253	-0.09839	-0.31436	0.02705
Front.Prot/Retr.	0.08937	0.11070	-0.02319	0.89940	0.10940
Nasal Prot/Retr.	-0.15935	0.10654	-0.08864	-0.29171	0.21519
Labial Pro/Retr.	-0.06306	0.36582	-0.13446	-0.32344	0.12383
Mandibular Pr/Rt.	-0.07004	0.19167	-0.16353	-0.42470	0.07811
Ht.of Forehead	0.55781	0.04088	0.00824	-0.07426	0.07027
Ht.of Upp.Face	0.79737	-0.04489	0.20959	0.01055	0.03830
Vert.Ht.Low Face	0.80879	-0.13556	0.31726	0.06481	0.04269

Table A5.1 - Factor Analysis - Distance Measurements, Angles and Relationships (continued)

VARIABLES	FACTOR 6	FACTOR 7	FACTOR 8	FACTOR 9	FACTOR 10
Nasal Breadth	-0.00481	-0.10722	-0.02978	-0.04746	-0.02407
Bizygomatic Diam.	0.02218	-0.03358	-0.04127	-0.03725	-0.02650
Biaural Breadth	-0.02874	0.09170	-0.01832	-0.01373	-0.01036
Inter-Occ.Dist.	0.03806	-0.12741	-0.58646	-0.01687	-0.06208
Bioccular Diam.	0.05375	-0.09428	-0.05039	-0.03168	-0.07242
Mouth Width	0.04341	-0.07513	-0.02308	0.46787	-0.04317
Upper Lip Height	0.06420	-0.16903	-0.09266	0.14930	-0.06536
Lower Lip Height	0.04251	-0.08092	-0.03918	0.13492	-0.00361
Orbit-Aur.Dist.	-0.00309	0.04282	-0.02892	0.10139	0.02024
Total Ht.of Lips	0.05396	-0.13366	-0.07273	0.15187	-0.03852
Rt.Eye Fiss. Wth	0.03567	-0.07928	0.18329	-0.10587	-0.00032
Lft.Eye Fiss.Wth	0.02797	-0.03276	0.18615	-0.06528	-0.03720
Rt.Eye Fiss.Ht.	0.01181	-0.06112	0.07964	-0.03073	-0.00205
Lt.Eye Fiss.Ht.	0.00924	-0.04602	0.04019	-0.00595	0.00239
Height of Face	0.01698	0.06197	-0.00599	0.04869	0.08409
Auricle-Chin Dist	0.00848	0.06215	-0.01694	0.10882	0.03926
Nasal Prom.	-0.01898	0.67604	0.07722	0.01803	0.11794
Nasal Bridge Dist	-0.03269	0.30866	-0.03883	-0.01504	0.03634
Nasal Height	0.01354	0.07512	0.02572	0.01574	0.16937
Ht.Whole Upp.Lip	-0.01076	-0.04296	-0.05877	0.05046	-0.44123
Columella Length	0.03646	0.09208	-0.00092	-0.03694	0.11980
Nasal Angle	-0.02574	-0.11053	-0.02582	-0.05846	0.06822
Nasal Base Angle	0.05196	-0.08382	-0.00823	0.04493	-0.09520
Nasal Wing/Sept.	-0.08548	0.13064	-0.02270	-0.13064	-0.03739
Upper Lip Angle	-0.01843	-0.29540	-0.03883	0.14947	-0.03442
Chin Angle	-0.09365	-0.07814	-0.03187	0.03812	0.17747
Front.Rec.Angle	-0.18765	-0.05561	0.01653	-0.16700	-0.08769
Front.Prot/Retr.	0.04374	0.07969	-0.00085	-0.01817	0.17719
Nasal Prot/Retr.	-0.12877	0.24231	-0.01499	-0.08935	0.01333
Labial Pro/Retr.	-0.01801	0.20117	0.05881	-0.14177	0.07817
Mandibular Pr/Rt.	-0.01369	0.07053	0.02396	-0.05831	-0.08965
Ht.of Forehead	-0.63976	0.11082	-0.01286	0.09364	-0.01568
Ht.of Upp.Face	0.19070	0.02481	-0.07827	0.10796	0.07489
Vert.Ht.Low Face	0.03818	-0.00360	-0.01136	0.07203	0.06000

Table A5.1 - Factor Analysis - Distance Measurements, Angles and Relationships (continued)

VARIABLES	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14	FACTOR 15
Nasal Breadth	-0.15368	0.03151	-0.35199	-0.00635	-0.15536
Bizygomatic Diam.	-0.04214	0.04249	-0.04130	0.02225	0.18737
Biaural Breadth	0.06122	-0.00951	-0.01666	0.03831	0.08779
Inter-Occ.Dist.	-0.07886	0.04876	-0.11126	0.00034	-0.05746
Bioccular Diam.	-0.05453	0.05961	-0.06462	-0.00041	-0.15435
Mouth Width	-0.08163	0.05501	-0.11560	-0.01968	-0.06566
Upper Lip Height	0.01844	0.15667	-0.21416	-0.07238	-0.04136
Lower Lip Height	-0.03044	0.07565	0.10246	0.03799	-0.07024
Orbit-Aur.Dist.	-0.30555	0.07416	-0.03000	0.01305	0.00234
Total Ht.of Lips	-0.02799	0.13215	-0.06538	-0.02024	-0.05136
Rt.Eye Fiss. Wth.	-0.02137	0.08588	0.02976	-0.01087	-0.13362
Lft.Eye Fiss.Wth.	0.01339	0.08737	0.02639	0.01182	-0.14139
Rt.Eye Fiss.Ht.	-0.03707	0.66467	-0.03131	0.04360	-0.05647
Lt.Eye Fiss.Ht.	-0.05829	0.66809	-0.02068	0.03719	-0.07948
Height of Face	0.17924	0.00932	-0.00864	0.04216	0.05470
Auricle-Chin Dist	-0.01633	0.06283	-0.04566	0.05130	-0.03147
Nasal Prom.	0.07612	-0.04245	0.03420	0.06733	0.08058
Nasal Bridge Dist	0.07374	-0.01094	0.00424	0.02227	0.07924
Nasal Height	0.17334	-0.03246	0.02299	0.04452	0.08797
Ht.Whole Upp.Lip	0.05982	-0.01679	0.00797	0.01246	-0.01681
Columella Length	0.10440	0.03404	0.02522	0.77811	0.06514
Nasal Angle	-0.00816	-0.01555	0.02031	-0.05081	0.03567
Nasal Base Angle	0.01188	0.03211	-0.05060	-0.06522	-0.02510
Nasal Wing/Sept.	0.08352	-0.12473	0.20732	-0.01969	0.04424
Upper Lip Angle	0.04668	0.13525	-0.23622	-0.10841	-0.09559
Chin Angle	0.06023	-0.01479	-0.01003	0.01990	-0.00781
Front.Rec.Angle	0.03288	-0.12207	0.07585	-0.11150	0.11613
Front.Prot/Retr.	0.08756	0.01508	0.01764	0.04781	0.03619
Nasal Prot/Retr.	-0.03942	0.06604	-0.00434	-0.00608	-0.03469
Labial Pro/Retr.	-0.10729	-0.00882	0.18614	0.09992	0.11007
Mandibular Pr/Rt.	0.07017	-0.06150	0.01688	0.01899	-0.00843
Ht.of Forehead	0.01994	0.08202	-0.08356	0.05422	0.03162
Ht.of Upp.Face	-0.00403	0.11534	0.08922	0.13629	-0.07913
Vert.Ht.Low Face	0.10583	0.03517	0.00318	0.03491	-0.00121

Table A5.2 - Factor Analysis - Indices

VARIABLES	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
Ear Protr. Index	0.10504	-0.33148	0.13467	0.25732	-0.04137
Mouth Index	0.00357	0.87443	-0.07475	-0.07888	0.09287
Lip Index	-0.02957	-0.05690	-0.00371	0.21471	-0.03839
Eye Fissure Index	-0.06002	0.28722	-0.05800	-0.05265	0.01452
Mouth Width Index	-0.12565	0.32711	-0.07562	-0.20566	0.09083
Nasal Breadth Index	-0.06846	0.55903	-0.15082	-0.22573	0.15785
Int.Occ.Wth.Index	-0.02759	0.28074	-0.05409	-0.08965	0.04076
Bi-Occ.Wth.Index	-0.03088	0.36022	-0.08815	-0.11010	0.11813
Occular Index	-0.01676	0.12857	-0.02033	-0.03993	-0.01595
Biocc.Mth.Wth.Ind.	-0.13124	0.17093	-0.03285	-0.17648	0.03823
Mth.Nose Wth.Index	0.05874	0.32471	-0.09085	-0.04956	0.09066
Int.Occ.Nas.Wth.Ind.	-0.03626	0.30287	-0.06845	-0.15665	0.11525
Upp.Fce-Frhd.Ht.Ind.	0.13093	-0.07566	-0.17875	0.08296	-0.04156
Upp-Low.Fcl.Ht.Index	-0.00523	0.12906	-0.71815	-0.10084	-0.01449
Low.Fce-Frhd.Ht.Ind.	0.14012	-0.17895	0.30325	0.14781	-0.03728
Low.Fce.Prop.Index	0.12917	0.03802	-0.00250	0.09866	-0.07004
Nas.Ht.-Prom.Index	0.02368	-0.11832	-0.22781	-0.18607	-0.13399
Nas.Prom-Brid.Index	-0.02821	-0.00280	-0.01089	0.03253	-0.94836
Whole Upp.LipVert.Ind.	0.02388	0.24216	-0.59804	-0.17347	0.07117
Nas.Col.Length Index	-0.11117	-0.05066	-0.01070	-0.06736	-0.01323
Lat.Prop.Index I	0.21731	-0.06976	0.11650	0.53168	0.10006
Lat.Prop.Index II	0.07236	0.20890	-0.07410	-0.31407	0.06021
Lat.Prop.Index III	0.08098	0.24732	0.16727	0.70635	0.00354
Nas.Prom.Lat.Index	0.08419	0.33137	0.21573	0.28805	-0.18035
Nas.Brid.Dist.Lat.Ind.	0.00719	-0.10793	0.05532	0.13199	-0.92001
Low.Fce.Ht.Vert.Index	0.05389	-0.26589	0.81166	0.30849	-0.13771
Gen.Fac.Size Fact.Ind.	0.91965	-0.09583	0.01991	0.13389	0.07307
Nas Bridge Index	0.09374	0.43415	-0.35820	-0.34131	0.21828
Nas.Prom. Index	0.00143	0.20597	-0.10847	-0.10073	0.84128
Nasal Index	0.05134	0.32036	-0.19349	-0.12883	0.24729

Table A5.2 (continued)

VARIABLES	FACTOR 6	FACTOR 7	FACTOR 8	FACTOR 9	FACTOR 10
Ear Protr. Index	0.11992	-0.27828	0.06939	-0.03543	-0.03319
Mouth Index	-0.02537	0.10805	0.06688	0.15797	0.01895
Lip Index	0.05468	-0.14321	0.09091	0.07564	-0.10478
Eye Fissure Index	0.00489	0.04352	0.09643	-0.03946	-0.05216
Mouth Width Index	-0.05014	0.08974	0.01118	-0.79166	0.04618
Nasal Breadth Index	0.02552	0.14054	0.00752	-0.11562	0.01638
Int.Occ.Wth.Index	-0.02305	0.15334	0.86549	-0.00925	0.05174
Bi-Occ.Wth.Index	-0.07534	0.15728	0.02932	-0.00934	0.10526
Occular Index	0.01620	0.09047	0.93436	-0.01514	0.00443
Biocc.Mth.Wth.Ind.	-0.01474	0.01038	-0.02757	-0.08929	-0.01460
Mth.Nose Wth.Index	0.07913	0.06351	0.02216	0.68090	-0.13903
Int.Occ.Nas.Wth.Ind.	0.04288	-0.01412	-0.74643	-0.10855	-0.05370
Upp.Fce-Frhd.Ht.Ind.	0.83237	-0.07152	-0.05583	-0.00569	0.10267
Upp-Low.Fcl.Ht.Index	0.20815	0.03543	-0.08789	0.03883	0.05450
Low.Fce-Frhd.Ht.Ind.	0.77203	-0.10717	-0.00274	-0.04084	0.08582
Low.Fce.Prop.Index	0.07002	0.06336	0.07926	0.02478	0.74481
Nas.Ht.-Prom.Index	0.03319	-0.88857	-0.08599	-0.02054	0.01293
Nas.Prom-Brid.Index	0.04391	0.10923	0.02006	-0.00600	0.01254
Whole Upp.LipVert.Ind.	0.02518	0.11063	0.07604	-0.03239	0.59274
Nas.Col.Length Index	-0.02171	-0.05461	0.00906	0.05162	-0.02171
Lat.Prop.Index I	0.03817	0.07022	0.03526	0.03466	0.04998
Lat.Prop.Index II	0.02866	0.04034	0.04098	-0.08944	0.08444
Lat.Prop.Index III	0.00347	0.01802	-0.00851	0.11480	-0.04954
Nas.Prom.Lat.Index	0.03680	-0.77036	-0.11469	0.05576	-0.10481
Nas.Brid.Dist.Lat.Ind.	0.05750	-0.15686	-0.02510	0.01206	-0.00683
Low.Fce.Ht.Vert.Index	0.05988	-0.07500	-0.03934	0.04733	-0.13147
Gen.Fac.Size Fact.Ind.	0.01300	0.03594	-0.02434	0.05801	0.03230
Nas.Bridge Index	0.01400	0.15087	0.04636	-0.03826	0.15242
Nas.Prom. Index	-0.04521	0.31217	-0.02584	-0.03770	0.02056
Nasal Index	-0.03333	0.81106	0.12220	0.04733	0.13146

Table A5.2 (continued)

VARIABLES	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14	FACTOR 15
Ear Protr. Index	-0.20615	0.13527	-0.05835	-0.03794	0.17151
Mouth Index	0.02127	-0.15160	-0.07346	-0.00026	0.04125
Lip Index	0.10478	0.10273	0.41489	-0.15246	0.01939
Eye Fissure Index	0.07906	-0.23548	0.06238	-0.04148	-0.02967
Mouth Width Index	0.08124	-0.01294	0.15930	0.06130	0.31999
Nasal Breadth Index	0.19319	0.00357	0.48828	0.02829	0.40579
Int.Occ.Wth.Index	0.07004	-0.01722	0.11615	0.00824	0.29067
Bi-Occ.Wth.Index	-0.05257	-0.04537	0.06766	0.04633	0.72945
Occular Index	0.05572	0.04527	0.08889	-0.01180	-0.09662
Biocc.Mth.Wth.Ind.	0.07069	0.00321	0.14015	0.03939	-0.08287
Mth.Nose Wth.Index	0.13903	0.01970	0.41966	-0.03885	0.15798
Int.Occ.Nas.Wth.Ind.	0.13274	0.03596	0.37788	0.00709	0.15555
Upp.Fce-Frhd.Ht.Ind.	0.04971	-0.00466	0.18189	0.06455	-0.10268
Upp-Low.Fcl.Ht.Index	0.17767	-0.10630	0.11547	0.12173	-0.19293
Low.Fce-Frhd.Ht.Ind.	0.06968	-0.06810	0.11394	-0.00741	-0.03702
Low.Fce.Prop.Index	0.04571	0.07848	-0.00726	0.08483	0.02212
Nas.Ht.-Prom.Index	-0.09331	-0.02414	0.12684	0.01267	0.09687
Nas.Prom-Brid.Index	0.03540	-0.01120	-0.02727	-0.05273	-0.02242
Whole Upp.LipVert.Ix	0.06532	-0.00545	-0.02394	-0.02800	0.01209
Nas.Col.Length Index	0.01406	-0.04663	0.02493	0.06374	0.09651
Lat.Prop.Index I	0.64991	-0.02964	-0.00347	-0.00083	-0.09980
Lat.Prop.Index II	-0.82608	-0.12055	-0.03345	-0.08914	0.00175
Lat.Prop.Index III	0.34321	0.09498	0.08834	-0.00064	-0.02051
Nas.Prom.Lat.Index	0.09009	0.05648	-0.04027	0.10244	-0.07403
Nas.Brid.Dist.Lat.Ix	0.01320	0.00036	0.05135	0.04388	0.10161
Low.Fce.Ht.Vert.Ind.	0.08690	0.07527	-0.07236	0.03557	-0.16753
Gen.Fac.Size Fact.	0.27063	0.04924	-0.06071	-0.02225	-0.12237
Nas Bridge Index	0.26119	-0.04397	-0.03309	-0.02136	-0.01905
Nas.Prom. Index	0.09592	0.04316	0.00305	-0.00082	-0.09979
Nasal Index	-0.08689	0.07569	-0.05499	0.03695	0.21026

APPENDIX 6 - Results for Magazine Models

App.6(a) - Magazine Models - Female Adults - Descriptive Statistics

Table A6.1 - Angles

VARIABLE	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
Nasal Angle	40	65.000	0.764	4.830	+0.110	-0.307	52	75
Nasal Base Angle	40	3.125	0.648	4.096	+0.512	-0.415	-9	+14
Upper Lip Angle	40	8.175	1.605	10.150	+0.145	-0.275	-20	+27
Chin Angle	40	-11.250	0.792	5.012	-0.206	-0.286	-23	-2
Frontal Recess Angle	37	78.838	0.573	3.484	+0.687	-0.310	70	87

Table A6.2 - Relationships

VARIABLE	n	0/0	+/+	+/-	-/+	-/-	+/0	0/+	0/-	-/0
		0	1	2	3	4	5	6	7	8
Nasal Wing Septum Rel.	40	0	40%	12.5%	0	0	0	0	47.5%	0

Table A6.3 - Relationships (Protraction and Retraction from Vertical Facial Plane)

VARIABLE	n	PROT.	RETR.	VERT.
FRONTAL	40	70.0%	20.0%	10.0%
NASAL	40	2.5%	95.0%	2.5%
LABIAL	40	72.5%	22.5%	5.0%
MANDIBULAR	40	2.5%	92.5%	5.0%

Table A6.4 - Female Adult Magazine Models - Descriptive Statistics

Indices using Front View Only

VARIABLE	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
Ear Protrusion Index	126	0.839	0.004	0.040	-0.352	+0.132	0.737	0.945
Mouth Index	125	2.754	0.043	0.479	+3.865	+1.208	1.667	5.000
Lip Index	124	0.717	0.014	0.151	+0.457	+0.390	0.333	1.167
Eye Fissure Index	129	3.311	0.060	0.679	+6.476	+1.570	1.500	7.000
Occular Index	130	3.099	0.025	0.284	+0.016	+0.467	2.455	3.875
Mouth Width Index	129	2.722	0.020	0.225	+0.413	-0.229	2.036	3.300
Nasal Breadth Index	130	4.109	0.032	0.366	-0.068	+0.496	3.333	5.143
Int-Occular Width Index	130	4.472	0.033	0.374	+0.707	+0.743	3.733	5.667
Biocculer Width Index	130	1.445	0.006	0.066	-0.570	+0.143	1.318	1.618
Mouth-Nose Width Index	129	1.514	0.012	0.138	+0.027	-0.037	1.111	1.867
Biocc-Mouth Width Index	129	1.887	0.014	0.164	+1.572	+0.100	1.400	2.500
Interoccular Nasal Wth.Index	130	0.924	0.009	0.105	-0.238	+0.149	0.667	1.158

Table A6.5 - Male Adult Magazine Models - Descriptive Statistics

Indices using Front View Only

VARIABLE	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
Ear Protrusion Index	18	0.808	0.009	0.040	-0.366	+0.699	0.750	0.885
Mouth Index	17	3.707	0.274	1.129	+3.976	+1.935	2.667	7.000
Lip Index	17	0.662	0.091	0.376	+11.169	+3.160	0.333	2.000
Eye Fissure Index	18	4.112	0.289	1.227	-0.595	+0.685	2.667	6.800
Occular Index	18	3.123	0.126	0.536	+2.838	+1.462	2.500	4.667
Mouth Wth.Index	18	2.416	0.058	0.248	-1.015	-0.062	2.000	2.846
Nasal Breadth Index	18	3.744	0.072	0.306	-0.491	+0.638	3.333	4.375
Int.-Occular Width Index	18	4.487	0.164	0.697	+1.401	+1.141	3.500	6.333
Biocculer Width Index	18	1.442	0.020	0.083	-1.232	-0.051	1.313	1.567
Mouth - Nose Width Index	18	1.562	0.042	0.178	-0.238	-0.137	1.182	1.875
Bioccular Mouth Width Index	18	1.679	0.042	0.176	-0.543	-0.302	1.313	1.944
Interoccular Nasal Wth.Index	18	0.849	0.028	0.120	-0.554	-0.256	0.600	1.000

Table A6.6 - Female Adult Magazine Models - Descriptive Statistics

Indices using Profile View Only

VARIABLE	n	MEAN	S.E.	S.D.	KURT.	SKEW.	MIN.	MAX.
Upper Face Frhd.Ht.Index	39	1.169	0.037	0.234	+0.981	+1.033	0.786	1.846
Upper-Lower Facial Ht.Ind	40	1.095	0.018	0.111	+2.594	-0.915	0.709	1.292
Nasal Prom. Bridge Index	40	1.566	0.041	0.259	+0.857	+1.007	1.125	2.333
Nasal Col. Length Index	40	7.590	0.319	2.015	+1.065	+0.734	4.333	14.000
Lateral Prop. Index I	40	1.685	0.034	0.215	+9.928	+2.186	1.200	2.636
Lateral Prop. Index II	39	1.463	0.026	0.163	+4.342	+1.126	1.029	2.000
Lateral Prop. Index III	39	1.154	0.016	0.102	+10.160	+2.282	0.962	1.611
Nasal Prom. Lateral Index	39	4.582	0.086	0.540	+1.440	+0.916	3.571	6.000
Nasal Bridge Dist.Lat.Index	39	7.164	0.203	1.270	+0.922	+0.918	5.000	11.000
Lower Face Frhd.Ht.Index	39	1.057	0.030	0.186	+0.059	+0.780	0.748	1.538
Nasal Height Prom. Index	40	1.742	0.032	0.203	+0.577	+0.865	1.400	2.286
Lower Face Prop. Index	40	3.025	0.060	0.378	-0.817	+0.152	2.333	3.667
Whole Upp.Lip Vert. Index	40	2.466	0.072	0.455	-0.522	+0.444	1.556	3.333
Lower Facial Ht.Vert.Index	40	1.244	0.021	0.134	-0.820	+0.155	1.000	1.500

APPENDIX 6b

Table A6.7 - Mann Whitney U Test Results - Mag. Models - Angles

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	24.38	M. MOD.	FA	40	22.31	0.7678	X	X
M.MOD.	MA	4	77.38	G.B.	MA	99	50.97	0.0832	X	X
M.MOD.	FA	40	66.46	G.B.	FA	70	49.24	0.0063	✓	✓
M.MOD.	MA	4	26.38	N.E.G.B.	MA	35	19.27	0.2486	X	X
M.MOD.	FA	40	30.96	N.E.G.B.	FA	19	27.97	0.5310	X	X
M.MOD.	MA	4	53.50	REST.G.B.	MA	64	33.31	0.0464	✓	X
M.MOD.	FA	40	56.00	REST.G.B.	FA	51	38.16	0.0013	✓	✓
M.MOD.	MA	4	243.38	TANZ.	MA	267	134.39	0.0057	✓	✓
M.MOD.	FA	40	85.44	TANZ.	FA	82	49.82	0.0000	✓	✓

Nasal Angle

Nasal Base Angle

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	25.25	M.MOD.	FA	40	22.22	0.6793	X	X
M.MOD.	MA	4	59.25	G.B.	MA	99	51.71	0.6387	X	X
M.MOD.	FA	40	55.74	G.B.	FA	70	55.36	0.9528	X	X
M.MOD.	MA	4	24.75	N.E.G.B.	MA	35	19.46	0.4066	X	X
M.MOD.	FA	40	30.42	N.E.G.B.	FA	19	29.11	0.7818	X	X
M.MOD.	MA	4	37.00	REST.G.B.	MA	64	34.34	0.8113	X	X
M.MOD.	FA	40	45.81	REST.G.B.	FA	51	46.15	0.9520	X	X
M.MOD.	MA	4	40.88	TANZ.	MA	267	137.43	0.0143	✓	X
M.MOD.	FA	40	35.57	TANZ.	FA	82	74.15	0.0000	✓	✓

Upper Lip Angle

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	21.75	M.MOD.	FA	40	22.57	0.9216	X	X
M.MOD.	MA	4	69.13	G.B.	MA	99	51.31	0.2531	X	X
M.MOD.	FA	40	76.13	G.B.	FA	70	43.71	0.0000	✓	✓
M.MOD.	MA	4	26.25	N.E.G.B.	MA	35	19.29	0.2683	X	X
M.MOD.	FA	40	34.81	N.E.G.B.	FA	19	19.87	0.0018	✓	✓
M.MOD.	MA	4	45.38	REST.G.B.	MA	64	33.82	0.2683	X	X
M.MOD.	FA	40	61.81	REST.G.B.	FA	51	33.6	0.0000	✓	✓
M.MOD.	MA	4	7.88	TANZ.	MA	267	137.92	0.0010	✓	✓
M.MOD.	FA	40	26.65	TANZ.	FA	82	78.50	0.0000	✓	✓

Table A6.7 (continued)

Chin Angle

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	4	32.63	M. MOD.	FA	40	21.49	0.0995	X	X
M.MOD.	MA	4	76.00	G.B.	MA	98	50.50	0.0936	X	X
M.MOD.	FA	40	55.29	G.B.	FA	70	55.62	0.9577	X	X
M.MOD.	MA	4	27.75	N.E.G.B.	MA	35	19.11	0.1639	X	X
M.MOD.	FA	40	29.64	N.E.G.B.	FA	19	30.76	0.8134	X	X
M.MOD.	MA	4	50.75	REST.G.B.	MA	63	32.94	0.0781	X	X
M.MOD.	FA	40	46.15	REST.G.B.	FA	51	45.88	0.9616	X	X
M.MOD.	MA	4	189.38	TANZ.	MA	267	135.20	0.1692	X	X
M.MOD.	FA	40	48.99	TANZ.	FA	82	67.60	0.0062	✓	✓

Frontal Recession Angles

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	4	7.25	M.MOD.	FA	37	22.49	0.0120	✓	X
M.MOD.	MA	4	30.50	G.B.	MA	98	52.36	0.1553	X	X
M.MOD.	FA	37	47.24	G.B.	FA	67	55.40	0.1853	X	X
M.MOD.	MA	4	11.13	N.E.G.B.	MA	35	21.01	0.1018	X	X
M.MOD.	FA	37	28.97	N.E.G.B.	FA	19	27.58	0.7605	X	X
M.MOD.	MA	4	21.88	REST.G.B.	MA	63	34.77	0.2079	X	X
M.MOD.	FA	37	37.27	REST.G.B.	FA	48	47.42	0.0594	X	X
M.MOD.	MA	4	125.00	TANZ.	MA	267	136.16	0.7769	X	X
M.MOD.	FA	37	78,20	TANZ.	FA	82	51.79	0.0001	✓	✓

APPENDIX 6c

Table A6.8 - Mann Whitney U Test - Mag. Models - Relationships

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	4	21.74	M.MOD.	FA	40	22.57	0.9216	X	X
M.MOD.	MA	4	63.50	G.B.	MA	99	51.54	0.4521	X	X
M.MOD.	FA	40	61.76	G.B.	FA	70	51.92	0.0859	X	X
M.MOD.	MA	4	25.00	N.E.G.B.	MA	35	19.43	0.3812	X	X
M.MOD.	FA	40	32.66	N.E.G.B.	FA	19	24.39	0.0582	X	X
M.MOD.	MA	4	41.00	REST.G.B.	MA	64	34.09	0.5207	X	X
M.MOD.	FA	40	49.60	REST.G.B.	FA	51	43.18	0.2051	X	X
M.MOD.	MA	4	188.00	TANZ.	MA	267	135.22	0.0185	✓	X
M.MOD.	FA	40	80.39	TANZ.	FA	83	53.14	0.0000	✓	✓

Nasal Wing/Septum Relationship

Table A6.8 (continued)

Frontal Protraction or Retraction

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	21.00	M. MOD.	FA	40	22.65	0.8286	X	X
M.MOD.	MA	4	40.38	G.B.	MA	99	52.47	0.4421	X	X
M.MOD.	FA	40	52.05	G.B.	FA	70	57.47	0.3119	X	X
M.MOD.	MA	4	16.13	N.E.G.B.	MA	35	20.44	0.4879	X	X
M.MOD.	FA	40	29.40	N.E.G.B.	FA	19	31.26	0.6360	X	X
M.MOD.	MA	4	26.75	REST.G.B.	MA	64	34.98	0.4415	X	X
M.MOD.	FA	40	43.15	REST.G.B.	FA	51	48.24	0.2814	X	X
M.MOD.	MA	4	115.38	TANZ.	MA	267	136.31	0.5324	X	X
M.MOD.	FA	40	62.60	TANZ.	FA	83	61.71	0.8724	X	X

Nasal Protraction or Retraction

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	22.50	M.MOD.	FA	40	22.50	1.0000	X	X
M.MOD.	MA	4	52.50	G.B.	MA	99	51.98	0.9803	X	X
M.MOD.	FA	40	55.99	G.B.	FA	70	55.22	0.7371	X	X
M.MOD.	MA	4	20.00	N.E.G.B.	MA	35	20.00	1.0000	X	X
M.MOD.	FA	40	30.00	N.E.G.B.	FA	19	30.00	1.0000	X	X
M.MOD.	MA	4	35.00	REST.G.B.	MA	64	34.47	0.9699	X	X
M.MOD.	FA	40	46.49	REST.G.B.	FA	51	45.62	0.6929	X	X
M.MOD.	MA	4	170.00	TANZ.	MA	267	135.49	0.2667	X	X
M.MOD.	FA	40	71.26	TANZ.	FA	83	57.54	0.0054	✓	✓

Labial Protraction or Retraction

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	23.13	M.MOD.	FA	40	22.44	0.8958	X	X
M.MOD.	MA	4	42.00	G.B.	MA	99	52.40	0.5146	X	X
M.MOD.	FA	40	41.82	G.B.	FA	70	63.31	0.0002	✓	✓
M.MOD.	MA	4	16.75	N.E.G.B.	MA	35	20.37	0.5765	X	X
M.MOD.	FA	40	29.15	N.E.G.B.	FA	19	31.79	0.4932	X	X
M.MOD.	MA	4	27.75	REST.G.B.	MA	64	34.92	0.5043	X	X
M.MOD.	FA	40	33.17	REST.G.B.	FA	51	56.06	0.0000	✓	✓
M.MOD.	MA	4	167.50	TANZ.	MA	267	135.53	0.0015	✓	✓
M.MOD.	FA	40	73.41	TANZ.	FA	83	56.50	0.0000	✓	✓

Table A6.8 (continued)

Mandibular Protraction/Retraction

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	4	22.13	M. MOD.	FA	40	22.54	0.9115	X	X
M.MOD.	MA	4	50.13	G.B.	MA	98	51.56	0.9271	X	X
M.MOD.	FA	40	56.30	G.B.	FA	70	55.04	0.7387	X	X
M.MOD.	MA	4	19.25	N.E.G.B.	MA	35	20.09	0.9111	X	X
M.MOD.	FA	40	30.21	N.E.G.B.	FA	19	29.55	0.8059	X	X
M.MOD.	MA	4	33.38	REST.G.B.	MA	63	34.04	0.9491	X	X
M.MOD.	FA	40	46.59	REST.G.B.	FA	51	45.54	0.7398	X	X
M.MOD.	MA	4	170.50	TANZ.	MA	267	135.48	0.3128	X	X
M.MOD.	FA	40	76.29	TANZ.	FA	83	55.11	0.0001	✓	✓

APPENDIX 6d

Table A6.9 - Mann Whitney U Test Results - Mag.Models - Indices using Front View only

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	18	45.39	M.MOD.	FA	127	76.92	0.0029	✓	✓
M.MOD.	MA	18	57.00	G.B.	MA	99	59.36	0.7857	X	X
M.MOD.	FA	127	105.32	G.B.	FA	69	85.94	0.0223	✓	X
M.MOD.	MA	18	28.11	N.E.G.B.	MA	35	26.43	0.7072	X	X
M.MOD.	FA	127	76.04	N.E.G.B.	FA	19	56.55	0.0611	X	X
M.MOD.	MA	18	38.39	REST.G.B.	MA	64	42.38	0.5304	X	X
M.MOD.	FA	127	93.29	REST.G.B.	FA	50	78.11	0.0760	X	X
M.MOD.	MA	18	59.22	TANZ.	MA	265	147.62	0.0000	✓	✓
M.MOD.	FA	127	93.96	TANZ.	FA	83	123.16	0.0007	✓	✓

Ear Protrusion Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	17	114.44	M.MOD.	FA	126	66.27	0.0000	✓	✓
M.MOD.	MA	17	62.82	G.B.	MA	96	55.97	0.4265	X	X
M.MOD.	FA	126	79.69	G.B.	FA	59	121.42	0.0000	✓	✓
M.MOD.	MA	17	22.76	N.E.G.B.	MA	34	27.62	0.2715	X	X
M.MOD.	FA	126	65.65	N.E.G.B.	FA	16	117.59	0.0000	✓	✓
M.MOD.	MA	17	49.06	REST.G.B.	MA	62	37.52	0.0661	X	X
M.MOD.	FA	126	77.54	REST.G.B.	FA	43	106.85	0.0007	✓	✓
M.MOD.	MA	17	248.79	TANZ.	MA	246	123.93	0.0000	✓	✓
M.MOD.	FA	126	119.15	TANZ.	FA	68	57.38	0.0000	✓	✓

Mouth Index

Table A6.9 (continued)

Lip Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	17	43.79	M. MOD.	FA	125	75.27	0.0027	✓	✓
M.MOD.	MA	17	45.06	G.B.	MA	96	59.11	0.1011	X	X
M.MOD.	FA	125	96.02	G.B.	FA	59	85.04	0.1894	X	X
M.MOD.	MA	17	23.71	N.E.G.B.	MA	34	27.15	0.4324	X	X
M.MOD.	FA	125	72.85	N.E.G.B.	FA	16	56.53	0.1287	X	X
M.MOD.	MA	17	30.35	REST.G.B.	MA	62	42.65	0.0484	✓	X
M.MOD.	FA	125	86.17	REST.G.B.	FA	43	79.65	0.4455	X	X
M.MOD.	MA	17	35.32	TANZ.	MA	254	142.74	0.0000	✓	✓
M.MOD.	FA	125	77.44	TANZ.	FA	78	141.35	0.0000	✓	✓

Eye Fissure Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	18	98.53	M.MOD.	FA	130	71.17	0.0111	✓	X
M.MOD.	MA	18	74.61	G.B.	MA	98	55.54	0.0270	✓	X
M.MOD.	FA	130	93.72	G.B.	FA	67	109.25	0.0700	X	X
M.MOD.	MA	18	30.42	N.E.G.B.	MA	35	25.24	0.2479	X	X
M.MOD.	FA	130	72.90	N.E.G.B.	FA	19	89.37	0.1201	X	X
M.MOD.	MA	18	53.69	REST.G.B.	MA	63	37.37	0.0094	✓	✓
M.MOD.	FA	130	88.32	REST.G.B.	FA	48	98.11	0.1751	X	X
M.MOD.	MA	18	224.03	TANZ.	MA	263	135.32	0.0000	✓	✓
M.MOD.	FA	130	122.17	TANZ.	FA	84	84.80	0.0000	✓	✓

Occular Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	18	70.17	M.MOD.	FA	131	75.66	0.6118	X	X
M.MOD.	MA	18	63.36	G.B.	MA	99	58.21	0.5531	X	X
M.MOD.	FA	131	106.94	G.B.	FA	70	89.89	0.0477	✓	X
M.MOD.	MA	18	29.06	N.E.G.B.	MA	35	25.94	0.4870	X	X
M.MOD.	FA	131	77.14	N.E.G.B.	FA	19	64.18	0.2238	X	X
M.MOD.	MA	18	43.81	REST.G.B.	MA	64	40.85	0.6420	X	X
M.MOD.	FA	131	95.79	REST.G.B.	FA	51	90.47	0.0778	X	X
M.MOD.	MA	18	196.08	TANZ.	MA	265	138.33	0.0038	✓	✓
M.MOD.	FA	131	134.77	TANZ.	FA	84	66.24	0.0000	✓	✓

Table A6.9 (continued)

Mouth Width Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	18	33.92	M. MOD.	FA	130	80.12	0.0000	✓	✓
M.MOD.	MA	18	45.64	G.B.	MA	99	61.43	0.0692	X	X
M.MOD.	FA	130	113.90	G.B.	FA	69	73.81	0.0000	✓	✓
M.MOD.	MA	18	23.56	N.E.G.B.	MA	35	28.77	0.2442	X	X
M.MOD.	FA	130	80.40	N.E.G.B.	FA	19	38.08	0.0001	✓	✓
M.MOD.	MA	18	31.58	REST.G.B.	MA	64	44.29	0.0455	✓	X
M.MOD.	FA	130	99.00	REST.G.B.	FA	50	68.39	0.0004	✓	✓
M.MOD.	MA	18	198.44	TANZ.	MA	248	128.79	0.0002	✓	✓
M.MOD.	FA	130	125.28	TANZ.	FA	68	50.21	0.0000	✓	✓

Nasal Breadth Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	18	38.64	M.MOD.	FA	131	80.00	0.0001	✓	✓
M.MOD.	MA	18	68.69	G.B.	MA	99	57.24	0.1874	X	X
M.MOD.	FA	131	122.78	G.B.	FA	70	60.24	0.0000	✓	✓
M.MOD.	MA	18	31.56	N.E.G.B.	MA	35	24.66	0.1234	X	X
M.MOD.	FA	131	81.03	N.E.G.B.	FA	19	37.37	0.0000	✓	✓
M.MOD.	MA	18	46.64	REST.G.B.	MA	64	40.05	0.3000	X	X
M.MOD.	FA	131	107.75	REST.G.B.	FA	51	49.76	0.0000	✓	✓
M.MOD.	MA	18	272.06	TANZ.	MA	265	133.17	0.0000	✓	✓
M.MOD.	FA	131	149.74	TANZ.	FA	84	42.90	0.0000	✓	✓

Interoccular Width Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	18	67.33	M.MOD.	FA	131	76.05	0.4214	X	X
M.MOD.	MA	18	58.03	G.B.	MA	99	59.18	0.8948	X	X
M.MOD.	FA	131	105.26	G.B.	FA	70	93.03	0.1555	X	X
M.MOD.	MA	18	27.94	N.E.G.B.	MA	35	26.51	0.7494	X	X
M.MOD.	FA	131	76.23	N.E.G.B.	FA	19	70.50	0.5913	X	X
M.MOD.	MA	18	39.58	REST.G.B.	MA	64	42.04	0.6991	X	X
M.MOD.	FA	131	95.03	REST.G.B.	FA	51	82.42	0.1469	X	X
M.MOD.	MA	18	219.36	TANZ.	MA	265	136.75	0.0000	✓	✓
M.MOD.	FA	131	142.13	TANZ.	FA	84	54.77	0.0000	✓	✓

Table A6.9 (continued)

Bioccular Mouth Width Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	18	73.89	M. MOD.	FA	131	75.15	0.9073	X	X
M.MOD.	MA	18	46.50	G.B.	MA	99	61.27	0.0891	X	X
M.MOD.	FA	131	95.13	G.B.	FA	70	111.98	0.0504	X	X
M.MOD.	MA	18	23.53	N.E.G.B.	MA	35	28.79	0.2404	X	X
M.MOD.	FA	131	73.02	N.E.G.B.	FA	19	92.58	0.0667	X	X
M.MOD.	MA	18	32.47	REST.G.B.	MA	64	44.04	0.0687	X	X
M.MOD.	FA	131	86.11	REST.G.B.	FA	51	100.21	0.1642	X	X
M.MOD.	MA	18	192.33	TANZ.	MA	265	138.58	0.0070	✓	✓
M.MOD.	FA	131	128.41	TANZ.	FA	84	76.17	0.0000	✓	✓

Mouth-Nose Width Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	18	85.47	M.MOD.	FA	130	72.98	0.2462	X	X
M.MOD.	MA	18	80.58	G.B.	MA	99	55.08	0.0033	✓	✓
M.MOD.	FA	130	110.22	G.B.	FA	69	80.74	0.0006	✓	✓
M.MOD.	MA	18	34.08	N.E.G.B.	MA	35	23.36	0.0166	✓	X
M.MOD.	FA	130	75.08	N.E.G.B.	FA	19	74.45	0.9523	X	X
M.MOD.	MA	18	56.00	REST.G.B.	MA	64	37.42	0.0035	✓	✓
M.MOD.	FA	130	100.64	REST.G.B.	FA	50	64.13	0.0000	✓	✓
M.MOD.	MA	18	223.25	TANZ.	MA	248	126.00	0.0000	✓	✓
M.MOD.	FA	130	124.12	TANZ.	FA	68	52.44	0.0000	✓	✓

Bioccular-Mouth Width Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	18	35.58	M.MOD.	FA	130	79.89	0.0000	✓	✓
M.MOD.	MA	18	54.36	G.B.	MA	99	59.84	0.5282	X	X
M.MOD.	FA	130	115.67	G.B.	FA	69	70.48	0.0000	✓	✓
M.MOD.	MA	18	26.56	N.E.G.B.	MA	35	27.23	0.8805	X	X
M.MOD.	FA	130	81.15	N.E.G.B.	FA	19	32.95	0.0000	✓	✓
M.MOD.	MA	18	37.31	REST.G.B.	MA	64	42.68	0.3976	X	X
M.MOD.	FA	130	100.02	REST.G.B.	FA	50	65.74	0.0001	✓	✓
M.MOD.	MA	18	177.89	TANZ.	MA	248	130.28	0.0112	✓	X
M.MOD.	FA	130	121.85	TANZ.	FA	68	56.77	0.0000	✓	✓

Table A6.9 (continued)

Interoccular-Nasal Width Index

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	18	52.00	M. MOD.	FA	131	78.16	0.0153	✓	X
M.MOD.	MA	18	65.56	G.B.	MA	99	57.81	0.3724	X	X
M.MOD.	FA	131	114.80	G.B.	FA	70	75.18	0.0000	✓	✓
M.MOD.	MA	18	29.17	N.E.G.B.	MA	35	25.89	0.4629	X	X
M.MOD.	FA	131	78.58	N.E.G.B.	FA	19	54.29	0.0221	✓	X
M.MOD.	MA	18	45.89	REST.G.B.	MA	64	40.27	0.3757	X	X
M.MOD.	FA	131	102.22	REST.G.B.	FA	51	63.96	0.0000	✓	✓
M.MOD.	MA	18	202.69	TANZ.	MA	265	137.88	0.0011	✓	✓
M.MOD.	FA	131	132.91	TANZ.	FA	84	69.15	0.0000	✓	✓

APPENDIX 6e

TableA6.10 - Mann Whitney U Test - Results - Mag. Models

Indices using Profile View Only

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	25.88	M.MOD.	FA	39	21.60	0.5313	X	X
M.MOD.	MA	4	58.63	G.B.	MA	99	51.75	0.6625	X	X
M.MOD.	FA	39	45.41	G.B.	FA	60	52.98	0.1993	X	X
M.MOD.	MA	4	23.25	N.E.G.B.	MA	35	19.63	0.5765	X	X
M.MOD.	FA	39	30.21	N.E.G.B.	FA	18	26.39	0.4185	X	X
M.MOD.	MA	4	37.88	REST.G.B.	MA	64	34.29	0.7343	X	X
M.MOD.	FA	39	35.21	REST.G.B.	FA	42	46.38	0.0324	✓	X
M.MOD.	MA	4	142.38	TANZ.	MA	265	134.89	0.8485	X	X
M.MOD.	FA	39	52.01	TANZ.	FA	82	65.27	0.0518	X	X

SFTPIX

STTPIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	11.13	M.MOD.	FA	40	23.64	0.0617	X	X
M.MOD.	MA	4	52.88	G.B.	MA	98	51.44	0.9271	X	X
M.MOD.	FA	40	64.05	G.B.	FA	69	49.75	0.0227	✓	X
M.MOD.	MA	4	22.00	N.E.G.B.	MA	35	19.77	0.7378	X	X
M.MOD.	FA	40	32.91	N.E.G.B.	FA	18	21.92	0.0216	✓	X
M.MOD.	MA	4	33.38	REST.G.B.	MA	63	34.04	0.9491	X	X
M.MOD.	FA	40	51.64	REST.G.B.	FA	51	41.58	0.0711	X	X
M.MOD.	MA	4	166.13	TANZ.	MA	267	135.55	0.4385	X	X
M.MOD.	FA	40	86.97	TANZ.	FA	83	49.96	0.0000	✓	✓

Table A6.10 (continued)

TPTPIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	32.75	M. MOD.	FA	39	20.90	0.0750	X	X
M.MOD.	MA	4	63.75	G.B.	MA	98	51.00	0.4178	X	X
M.MOD.	FA	39	41.56	G.B.	FA	60	55.48	0.0183	✓	X
M.MOD.	MA	4	24.25	N.E.G.B.	MA	35	19.51	0.4599	X	X
M.MOD.	FA	39	28.76	N.E.G.B.	FA	18	29.53	0.8701	X	X
M.MOD.	MA	4	42.00	REST.G.B.	MA	63	33.49	0.4193	X	X
M.MOD.	FA	39	32.81	REST.G.B.	FA	42	48.61	0.0025	✓	✓
M.MOD.	MA	4	140.00	TANZ.	MA	265	134.92	0.8970	X	X
M.MOD.	FA	39	37.53	TANZ.	FA	82	72.16	0.0000	✓	✓

MLPIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	27.63	M.MOD.	FA	40	21.99	0.3986	X	X
M.MOD.	MA	4	44.13	G.B.	MA	97	51.28	0.6440	X	X
M.MOD.	FA	40	47.51	G.B.	FA	67	57.87	0.0945	X	X
M.MOD.	MA	4	18.25	N.E.G.B.	MA	34	19.65	0.8365	X	X
M.MOD.	FA	40	27.79	N.E.G.B.	FA	19	34.66	0.1500	X	X
M.MOD.	MA	4	28.38	REST.G.B.	MA	63	34.36	0.5653	X	X
M.MOD.	FA	40	40.22	REST.G.B.	FA	48	48.06	0.2567	X	X
M.MOD.	MA	4	148.38	TANZ.	MA	266	135.31	0.7397	X	X
M.MOD.	FA	40	57.13	TANZ.	FA	83	64.35	0.2921	X	X

NHPRMIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	21.00	M.MOD.	FA	40	22.65	0.8058	X	X
M.MOD.	MA	4	59.50	G.B.	MA	99	51.70	0.6270	X	X
M.MOD.	FA	40	55.79	G.B.	FA	70	55.34	0.9430	X	X
M.MOD.	MA	4	22.75	N.E.G.B.	MA	35	19.69	0.6391	X	X
M.MOD.	FA	40	29.09	N.E.G.B.	FA	19	31.92	0.5532	X	X
M.MOD.	MA	4	39.25	REST.G.B.	MA	64	34.20	0.6417	X	X
M.MOD.	FA	40	47.20	REST.G.B.	FA	51	45.06	0.7010	X	X
M.MOD.	MA	4	119.75	TANZ.	MA	267	136.24	0.6761	X	X
M.MOD.	FA	40	41.14	TANZ.	FA	82	71.43	0.0000	✓	✓

Table A6.10 (continued)

NSIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	27.63	M. MOD.	FA	40	21.99	0.4175	X	X
M.MOD.	MA	4	42.88	G.B.	MA	99	52.37	0.5472	X	X
M.MOD.	FA	40	36.71	G.B.	FA	70	66.24	0.0000	✓	✓
M.MOD.	MA	4	15.75	N.E.G.B.	MA	35	20.49	0.4599	X	X
M.MOD.	FA	40	25.63	N.E.G.B.	FA	19	39.21	0.0044	✓	✓
M.MOD.	MA	4	29.63	REST.G.B.	MA	64	34.80	0.6238	X	X
M.MOD.	FA	40	31.59	REST.G.B.	FA	51	57.30	0.0000	✓	✓
M.MOD.	MA	4	92.38	TANZ.	MA	266	136.15	0.2657	X	X
M.MOD.	FA	40	41.89	TANZ.	FA	82	71.07	0.0000	✓	✓

ULVIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	26.13	M.MOD.	FA	40	22.14	0.5676	X	X
M.MOD.	MA	4	60.63	G.B.	MA	98	51.13	0.5432	X	X
M.MOD.	FA	40	53.11	G.B.	FA	70	54.53	0.8191	X	X
M.MOD.	MA	4	15.75	N.E.G.B.	MA	35	20.49	0.4599	X	X
M.MOD.	FA	40	30.64	N.E.G.B.	FA	19	28.66	0.6787	X	X
M.MOD.	MA	4	40.75	REST.G.B.	MA	64	34.11	0.5373	X	X
M.MOD.	FA	40	42.97	REST.G.B.	FA	48	45.77	0.6091	X	X
M.MOD.	MA	4	242.50	TANZ.	MA	266	133.89	0.0057	✓	✓
M.MOD.	FA	40	89.59	TANZ.	FA	83	48.70	0.0000	✓	✓

NCVIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	24.88	M.MOD.	FA	40	22.36	0.7084	X	X
M.MOD.	MA	4	41.50	G.B.	MA	98	51.91	0.5104	X	X
M.MOD.	FA	40	48.46	G.B.	FA	70	59.52	0.0802	X	X
M.MOD.	MA	4	17.75	N.E.G.B.	MA	35	20.26	0.7044	X	X
M.MOD.	FA	40	26.59	N.E.G.B.	FA	19	37.18	0.0268	✓	X
M.MOD.	MA	4	26.25	REST.G.B.	MA	63	34.49	0.4344	X	X
M.MOD.	FA	40	42.38	REST.G.B.	FA	51	48.84	0.2462	X	X
M.MOD.	MA	4	23.75	TANZ.	MA	267	137.68	0.0039	✓	✓
M.MOD.	FA	40	24.92	TANZ.	FA	83	79.87	0.0000	✓	✓

Table A6.10 (continued)

CLVIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	19.00	M. MOD.	FA	40	22.85	0.5654	X	X
M.MOD.	MA	4	68.63	G.B.	MA	98	50.80	0.2482	X	X
M.MOD.	FA	40	73.39	G.B.	FA	70	45.28	0.0000	✓	✓
M.MOD.	MA	4	23.50	N.E.G.B.	MA	34	19.03	0.4759	X	X
M.MOD.	FA	40	32.21	N.E.G.B.	FA	19	25.34	0.1501	X	X
M.MOD.	MA	4	—	REST.G.B.	MA	—	—	—	—	—
M.MOD.	FA	40	61.67	REST.G.B.	FA	51	33.71	0.0000	✓	✓
M.MOD.	MA	4	159.25	TANZ.	MA	267	135.65	0.5500	X	X
M.MOD.	FA	40	80.96	TANZ.	FA	83	52.86	0.0000	✓	✓

LPIXA

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	29.00	M.MOD.	FA	39	21.28	0.2615	X	X
M.MOD.	MA	4	74.25	G.B.	MA	98	50.57	0.1216	X	X
M.MOD.	FA	39	68.41	G.B.	FA	70	47.53	0.0009	✓	✓
M.MOD.	MA	4	27.25	N.E.G.B.	MA	35	19.17	0.1949	X	X
M.MOD.	FA	39	33.40	N.E.G.B.	FA	19	21.50	0.0118	✓	X
M.MOD.	MA	4	49.50	REST.G.B.	MA	63	33.02	0.1054	X	X
M.MOD.	FA	39	55.01	REST.G.B.	FA	51	38.23	0.0025	✓	✓
M.MOD.	MA	4	194.00	TANZ.	MA	266	134.62	0.1312	X	X
M.MOD.	FA	39	64.06	TANZ.	FA	82	59.54	0.5074	X	X

LPIXB

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	SIG. 1%
M.MOD.	MA	4	27,88	M.MOD.	FA	39	21.40	0.3396	X	X
M.MOD.	MA	4	57.75	G.B.	MA	98	57.24	0.6837	X	X
M.MOD.	FA	39	51.54	G.B.	FA	70	56.93	0.3934	X	X
M.MOD.	MA	4	19.75	N.E.G.B.	MA	35	20.03	0.9822	X	X
M.MOD.	FA	39	27.45	N.E.G.B.	FA	19	33.71	0.1848	X	X
M.MOD.	MA	4	40.50	REST.G.B.	MA	63	33.59	0.5143	X	X
M.MOD.	FA	39	44.09	REST.G.B.	FA	51	46.58	0.6542	X	X
M.MOD.	MA	4	207.88	TANZ.	MA	266	134.41	0.0618	X	X
M.MOD.	FA	39	77.21	TANZ.	FA	82	53.29	0.0005	✓	✓

Table A6.10 (continued)

LPIXC

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	4	18.75	M. MOD.	FA	39	22.33	0.6140	X	X
M.MOD.	MA	4	69.00	G.B.	MA	98	50.79	0.2411	X	X
M.MOD.	FA	39	71.90	G.B.	FA	70	45.59	0.0000	✓	✓
M.MOD.	MA	4	30.75	N.E.G.B.	MA	35	18.77	0.0464	✓	X
M.MOD.	FA	39	34.76	N.E.G.B.	FA	19	18.71	0.0007	✓	✓
M.MOD.	MA	4	40.75	REST.G.B.	MA	63	33.57	0.4978	X	X
M.MOD.	FA	39	57.14	REST.G.B.	FA	51	36.60	0.0002	✓	✓
M.MOD.	MA	4	76.38	TANZ.	MA	267	136.89	0.1253	X	X
M.MOD.	FA	39	45.05	TANZ.	FA	32	68.59	0.0006	✓	✓

NPRMLIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	4	16.63	M.MOD.	FA	39	22.55	0.3832	X	X
M.MOD.	MA	4	60.00	G.B.	MA	98	51.15	0.5771	X	X
M.MOD.	FA	39	65.36	G.B.	FA	70	49.23	0.0106	✓	X
M.MOD.	MA	4	24.00	N.E.G.B.	MA	35	19.54	0.4879	X	X
M.MOD.	FA	39	30.49	N.E.G.B.	FA	19	27.47	0.5232	X	X
M.MOD.	MA	4	38.50	REST.G.B.	MA	63	33.71	0.6550	X	X
M.MOD.	FA	39	54.87	REST.G.B.	FA	51	38.33	0.0029	✓	✓
M.MOD.	MA	4	29.50	TANZ.	MA	267	137.60	0.0062	✓	✓
M.MOD.	FA	39	24.05	TANZ.	FA	82	78.57	0.0000	✓	✓

NBRDLIX

POP.	CAT.	n	MEAN RK	POP.	CAT.	n	MEAN RK.	PROB.	SIG. 5%	1%
M.MOD.	MA	4	24.25	M.MOD.	FA	39	21.77	0.7318	X	X
M.MOD.	MA	4	48.50	G.B.	MA	98	51.62	0.8483	X	X
M.MOD.	FA	39	43.67	G.B.	FA	70	61.31	0.0052	✓	✓
M.MOD.	MA	4	17.25	N.E.G.B.	MA	35	20.31	0.6391	X	X
M.MOD.	FA	39	26.58	N.E.G.B.	FA	19	35.50	0.0588	X	X
M.MOD.	MA	4	33.75	REST.G.B.	MA	63	34.02	0.9898	X	X
M.MOD.	FA	39	37.09	REST.G.B.	FA	51	51.93	0.0076	✓	✓
M.MOD.	MA	4	60.00	TANZ.	MA	266	136.64	0.0514	X	X
M.MOD.	FA	39	26.00	TANZ.	FA	82	77.65	0.0000	✓	✓

APPENDIX 7 - DISCRIMINANT FUNCTION ANALYSIS (ALL GROUPS)

POPULATIONS:- Magazine Models MA
Magazine Models FA
G. British MA
G. British FA
Tanzania MA
Tanzania FA

Table A7.1 - Standardized Discriminant Coefficients

Variables are ordered by the function with the largest coefficient

VARIABLES	FUNCTION 1	FUNCTION 2	FUNCTION 3
Mouth-Nose Width Index	2.67360*	-0.13448	-0.75630
Bioccular Mouth Width Index	2.42765*	0.14545	-0.69680
Nasal Breadth Index	-1.46037*	0.59722	0.44178
Lower Face-Mouth Level Index	0.60965*	-0.58098	-0.18970
Middle Face Index	-0.48542*	0.44728	0.09621
Mouth Ht. Vert. Index	0.26883*	0.23868	0.15555
Thirds of Face Index	-0.60490	0.65053*	-0.31212
Eye Fissure Index	-0.01062	0.43747*	0.07102
Golden Prop.Index VI	0.07790	-0.40209*	0.03230
Lip Index	-0.15847	-0.26210*	0.06864
Occular Index	-0.06329	0.11319	8.19380*
Interoccular Width Index	0.02186	0.10558	-8.01731*
Bioccular Width Index	1.73730	-0.33413	3.16928*
Golden Prop.Index II	0.13875	0.03431	0.58474*
Ear Protrusion Index	-0.32082	-0.07485	-0.52772*

FUNCTION 1 = 84.39% variance

FUNCTION 2 = 13.50% variance

These two functions were used to plot Scattergrams shown in Figures 7.20 (a - g).

APPENDIX 8 - THE CHI-SQUARED TEST

This test is used to determine whether a deviation from the experimental results is large enough to be significant. The Chi - -Squared Test consists of two steps:-

(1) Calculating the Chi-Squared value

(2) Determining how often a Chi-Squared value of a particular size is likely to be produced by chance alone.

The Chi-Squared (X^2) value is a measure of the amount of deviation between observed and expected results. The value can be expressed as follows:-

$$X^2 = \frac{(ob - ex)^2}{ex}$$

where:-

ob = observed value
ex = expected value

Table A8.1 - Chi-Squared Values

NUMBER of CLASSES	X^2 VALUES (EXPERIMENTAL DEVIATION)							
2 3 4	0.0002 0.020 0.115	0.004 0.103 0.352	0.455 1.386 2.366	1.074 2.408 3.665	1.642 3.219 4.642	2.706 4.605 6.251	3.841 5.991 7.815	6.635 9.210 11.345
Times in one hundred that chance alone could produce the deviation	99	95	50	30	20	10	5	1